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Police patrol deployment in small urban centers: an application of integrated management decision-making

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POLICE PATROL DEPLOYMENT IN SMALL URBAN CENTERS:
AN APPLICATION OF
INTEGRATED MANAGEMENT DECISION-MAKING

by
ROBERT W. TAYLOR

A dissertation submitted in partial fulfillment of the
requirements for the degree of

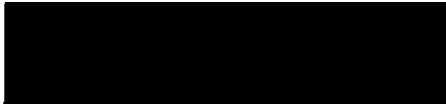
DOCTOR OF PHILOSOPHY
in
URBAN STUDIES

Portland State University

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TO THE OFFICE OF GRADUATE STUDIES AND RESEARCH:

The members of the Committee approved the dissertation of
Robert W. Taylor presented July 10, 1981.

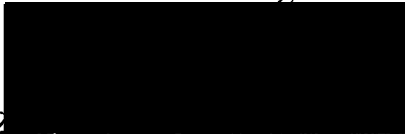

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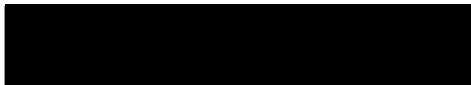

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AN ABSTRACT OF THE DISSERTATION OF Robert W. Taylor for the Doctor of
Philosophy in Urban Studies presented July 10, 1981.

Title: Police Patrol Deployment in Small Urban Centers: An
Application of Integrated Management Decision-making.

APPROVED BY MEMBERS OF THE DISSERTATION COMMITTEE:


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Donald Springer ✓

This dissertation was undertaken to examine and review the theoretical issues concerning decision-making. From this analysis, a new and innovative technique for problem-solving was developed, entitled Integrated Management Decision-making. The underlying theoretical framework of this model involved the integration of the organization

and the environment. Political, economic, social, cultural, and other community factors were discussed as major influences in the decision-making process. Integrated Management Decision-Making was derived from the combination of four existing theoretical perspectives: (1) decision-making is a process; (2) decision-making involves the ability to make rational choices; (3) decision-making assumes a systematic methodology; and (4) decision-making is conducted by human beings attempting to achieve a desired consequence or result.

Further, this study addressed the application of this new model to the task of police patrol deployment in small urban centers. The City of Jonesboro, Arkansas was used as a test case for the demonstration of this process.

After examining over 8,300 radio-dispatched calls for service in 1980, a method for deployment was proposed utilizing Integrated Management Decision-Making.

The statistical techniques of Multiple Response Analysis and Kruskal-Wallis Analysis of Variance by Ranks were utilized to explore the relationship between existing patrol procedures and proposed deployment design based on specific allocation variables designated by the police manager. The objective of the new deployment plan was to achieve an optimum patrol scheme with equalized workload between districts. This involved the determination of several decision-products: (1) the calculation of an assignment-availability factor; (2) the design of sector boundaries; (3) the calculation of shift requirements; and (4) the assessment of patrol strategies and techniques. This goal was achieved and recommendations for the Jonesboro Police Department were developed.

Finally, Integrated Management Decision-Making was discussed as a catalyst for change in current police management thinking. Futuristic concepts of organization-environmental learning, long-range planning, and strategic modeling were suggested as necessary improvements in police decision-making.

ACKNOWLEDGEMENTS

In the undertaking of any project, especially one of such magnitude as a doctoral dissertation, a successful completion can only be made at the encouragement and support of many others. It is for this reason, that I wish to acknowledge the assistance of the following people for their individual contributions, cooperation, and time:

To Dr. Charles Tracy, Committee Chairman, I am indebted for his continual support, encouragement, direction, and guidance during my research and graduate education. His thoughtful words and counseling were indeed a comfort during those times of stress. It is my pleasure to regard Dr. Tracy not only as my advisor, but also as my friend.

To Dr. Charles White, Dr. Jerry Lansdowne, and Dr. Donald Springer, members of my Dissertation Committee, I am also indebted for their valuable suggestions and assistance to me during this research. I extend my sincere thanks.

To Chief Edward Cunningham, Jonesboro, Arkansas Police Department, for his valuable assistance and helpful attitude in supplying necessary data and information, I am most grateful.

To my mother and father, for their continual support and encouragement, I give my respect and love.

To my mother-in-law and father-in-law for their genuine concern, understanding, and support, I extend my deepest gratitude.

And finally, while the primary participant in an endeavor such as this is willing to make sacrifices, it is those closest to him who sacrifice the most. Therefore, it is to my family that I dedicate this dissertation; to my wife Sherri, and children, Matt, Scott, and Laura I give my deepest appreciation and eternal love.

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CHAPTER I

INTRODUCTION

The efficient and effective use of police manpower has always been a problem, however, it has become increasingly serious in the last few years. That part of serious crime (reported to the police) in the United States has nearly doubled in the last decade, both totally and categorically, and the demand for police services has kept pace with this increase.¹ Clearly, this phenomenal increase in criminal activity has produced major and, in some areas, critical demands on the resources of municipal police agencies, i.e., personnel, facility, equipment, etc.² Unlike the 1960's and early 1970's, law enforcement agencies were unable to expand their level of service delivery because of a reluctance on the part of the local officials to continually increase the police budget. This reluctance can be attributed to several factors. For example, much of law enforcement's expansion during the last 15 years can be traced to the creation of the Federal Law Enforcement Assistance Administration, which provided substantial financial resources allegedly to improve police operations. Recently, a dramatic revision in the agency's guidelines and goals has severely cut what was once a relatively large fund for local police service improvement.³

To make financial matters even worse, an inflationary economy has produced further constraints and burdens on urban police budgets.

Major increases in gasoline prices and labor/personnel costs have forced many local governments to consider themselves in a state of crisis.⁴ Faced with rising crime and increased calls for service, a growing city would have traditionally sought to add more sworn police personnel. However, the inflationary cost to initially hire, train, and equip one patrol officer now ranges from \$10,000 to \$35,000 as compared to \$5,000 to \$12,000 just ten years ago. Such personnel costs account for 91 to 97 percent of the average department's total budget.⁵ Adding manpower may no longer be economically feasible; in fact, that option may not even be available to law enforcement managers in the current economic environment. With these dilemmas, it is understandable why city administrators are reluctant to increase police budgets.

To exacerbate this fiscal crisis, there is a current social and political movement that scrutinizes and questions government spending. Based in part on the public's cry for the efficient use of tax revenues, the movement centers around political awareness and an underlying tax revolt.⁶ The impending result is an increase of political pressure on city governments to justify expenditures.

Complicating this matter is a set of conflicting evidence about the effect of the police on crime. For the last 15 years, the common assumption that an increase in law enforcement patrol capability will result in a corresponding decrease in crime has been strongly challenged.⁷ Specifically, the well known Kansas City Preventative Patrol Experiment produced a plethora of controversy about the validity of this assumption.⁸ The study attempted to determine the effect routine patrol had on a number of different crime-related

measures. Different patrol techniques were used in three beats of the city. The "reactive" beat totally eliminated patrol activity, and only responded to calls for service. The "control" beat used routine patrol manpower with no change in personnel level. The "proactive" beat doubled or tripled patrol activity through an increase in manpower. The results of this study showed that none of the three levels of patrol manpower differed significantly in their effect on the level of crime as increased by victimization surveys and reported crime.⁹

Although there have been a number of criticisms aimed at the validity of the Kansas City study, the results have forced a re-examination of the traditional use of more funds and more manpower to combat the ever-increasing occurrences of crime. Indeed, James Q. Wilson has recently proposed that it may not be the number of police on patrol which produce lower crime rates, but the patrol behavior, style, or strategy which is employed by individual officers.¹⁰

These predicaments have been particularly troublesome for small urban centers, many of which are almost totally dependent on one primary economic base, i.e. farming, construction, mining, etc. Further, small cities are often characterized by strong political bodies which polarize the community into two separate groups. One is composed of those who support law enforcement and are usually associated with local business firms, fraternal orders, and small government bodies which form a distinct and visible power structure; while the other is made up of those who oppose law enforcement, and are frequently viewed as the target of police activities and usually represents those people who are "watched."¹¹ This second group is usually a segregated minority or a non-conventional public. In other

words, small cities exhibit a unique political and economic environment which is more acutely affected by rising crime rates and increased calls for service without corresponding increases in resources.¹²

Faced with denied requests for additional manpower, it is evident that the only realistic course of action left to deal with increasing crime and economic problems is to more effectively use the personnel and resources currently available within a given police department. This means that city managers must increase police productivity by improving current police practices to the best level known, that is, to get better performance without a proportionate increase in cost.¹³ One of the best methods to increase police productivity is to develop an allocation design which yields the most effective and efficient use of existing police resources.

The clearest example of increasing productivity is having personnel assigned when and where crime is highest or calls for service are heaviest.¹⁴ This is the primary goal in allocation design.

Police Patrol Allocation: An Historical Overview

Early Developments. The analysis of police patrol allocation in the United States began with the work of August Vollmer in Berkeley, California, during the early 1900's. Vollmer established a list of "police functions" which still appears in all standard manuals on municipal policing.¹⁵ With little variation, the list of police functions consists of the following items: crime prevention, crime repression, apprehension, criminal investigation, public service,

maintenance of peace and security, regulation of non-criminal activities, traffic control, and provision of emergency services. According to Vollmer, these functions described the police mission. He was the first to associate these functions with a territorial unit of work or the "beat." Vollmer's contribution to patrol allocation can be viewed twofold. First, he placed a priority emphasis on the study of the principles and methods of beat construction by formulating a criteria of allocation; patrolman should be distributed by areas in proportion to the amount of work to be done.¹⁶ And secondly, Vollmer initiated the concept of police work as a profession, rooted in the freedom of the police from political interference and the advancement of technological innovations in patrol assignments.

Even though Vollmer contributed much to the establishment of police professionalism and patrol strategy, there is a profound contradiction in American policing which he failed to address. It is futile to assert that the police can be or should be impartial in the face of political conflict between urban and rural, state and city, or religious and ethnic interest groups.¹⁷ This contradiction cannot be resolved by blaming undesirable police actions upon illegitimate political interference. Contrary to this thought, the police must consider, and act within, the political body of the community. This is particularly true in the decision-making process for manpower deployment. Political biases and structures must be considered as an important form of input for patrol allocation.

Recognizing this concept as early as 1920, Raymond Fosdick expanded on Vollmer's earlier thoughts. Noting that patrol deployment must change and alter with new political, economic, employment,

residential, and crime-occurring conditions, Fosdick proposed that the type and mode of patrol must adapt to new situations.¹⁸ He was the first to recognize the relationship between a changing community environment and a patrol strategy or allocation design that evolved with this situation.

In 1929, Bruce Smith in his book, Police Systems in the United States, recognized still another important aspect in patrol deployment. Indicating that patrol had been traditionally "distributed on an equal, or nearly equal, basis throughout the twenty-four hours of the day," despite marked increases in workload and crime occurrences, Smith advanced the use of crime analysis in allocation design.¹⁹ For the first time, patrol distribution was related to activity and crime documentation by police records. This was an important step for allocation design, as managers recognized the need to deploy personnel in an effort to maximize patrol activity during those times of highest crime and workload occurrence.

The Hazard Model. It was not until 1941, that the concept of effective distribution through maximum protection was fully realized. O. W. Wilson, then Chief of Police at Wichita, Kansas, established the "relative need" approach to police deployment. Emphasizing the redistribution of patrol forces based on a set of "proportionate need factors," Wilson utilized the application of law enforcement to the locations, during the times and toward the particular criminal violations which represented the highest police demands.²⁰

Elaborating on his original work, Wilson formulated a deployment scheme based on allocation by hazard.²¹ The formula was first initiated in the Los Angeles Police Department in 1953 and with

relatively minor changes, is still in use today. Each type of crime is given a weighted hazard score and, by prioritizing the incidence of crime, a total weighted sum for each region is calculated. The patrol personnel are allocated accordingly.

In a more recent statement concerning allocations by hazard, Roy C. McLaren re-emphasizes that "patrolmen should be distributed in proportion to the need for police service . . . the essence of the distribution problem lies in measuring the proportionate need."²²

For McLaren and Wilson this problem is remedied by the extensive use of a weighted scale in analyzing past historical data. Calls for service are examined in relation to a specific geographical area to form a criterion ratio. The Los Angeles Police Department exemplifies this deployment scheme by using the following ten weighted factors to calculate manpower allocation:²³

1. Percentage of FBI Index Crime per division (murder, armed robbery, forcible rape, aggravated assault, burglary, theft over \$200.00, and motor vehicle theft).
2. Percentage of radio calls
3. Percentage of adult and juvenile felony arrests
4. Percentage of adult and juvenile misdemeanor arrests
5. Percentage of property loss
6. Percentage of fatal and injury traffic accidents
7. Percentage of vehicles recovered
8. Percentage of Los Angeles City Population
9. Percentage of street miles, and
10. Percentage of population density

Unfortunately, such weight factors are largely subjective by nature and subject to criticism, a problem for which there appears to be no guidelines or formulating principles.²⁴ Further, the hazard formula is greatly affected by officer-initiated activity. The number of arrests made or crimes detected by officers may be a direct result of the number of officers in a particular region, thereby generating a spurious "need" for more manpower. On the other hand, the hazard formula cannot be dismissed as an erroneous venture in patrol planning. Established as one of the first analytical methods for deployment, the hazard formula utilizes a police data base in an attempt to equalize workload. It historically marks the first method of deployment which combined quantitative procedures and intuitive judgment. The hazard formula model still remains as one of the most widely utilized and accepted methods for municipal police allocation. As Donald Shanahan points out: "These weightings are not perfect, but until an improved system is developed, the assignment of weights according to classes of events is the best available."²⁵

The Phoenix Model. Employing the hazard formula concept with a predictive computer model has been one of the newer innovations for manpower deployment based on a proportionate need ratio. In the early 1960's, Phoenix, Arizona adopted such a system. It can be viewed as a sophisticated and natural evolvement from the hazard formula model.

In the Phoenix method, the basic hazard is defined as the delay plus travel plus service times for all calls during a given time period in a given place.²⁶ Cars are deployed by district, shift, and day of week in proportion to the fraction of the total citywide hazard predicted (by computer adaptation) to occur in that specific

time period and geographic region. The computer is used to extrapolate data from the previous ten weeks on the number of incidents and elapsed time (defined as delay time plus travel and service time) for each shift, day of week, and one-fourth-square-mile geographic area.²⁷

The Phoenix model proposes two constructive innovations to the hazard formula concept. They are (1) the use of predicted calls in the method rather than just calls actually experienced in the past and (2) the use of elapsed time rather than just volume of calls.

Unfortunately, the formula still involves the subjective weighting of incidents; and in this case, the limitation is even more serious as all calls receive the same weighting. Thus, a cold burglary or barking dog call receives an equal weight with a robbery or crime in progress. Another inherent weakness in the method is the failure to address the preventive and deterrent aspects of patrol. Kakalik and Wildhorn note this problem in their work entitled Aids to Decision-Making in Police Patrol. After administering an exhaustive survey to the Phoenix Department, they observe that while approximately 20-25 percent of a patrolman's time is allocated to preventive patrol, there still remains no direct value which can act as a weight or input for the computer application in the hazard formula prediction.²⁸

Further, as actual time spent on servicing an incident is computed by elapsed time factors, a theoretical argument can be raised. Since all calls receive the same weight and, the major use of the computer is in calculating "elapsed time," then the method does not distribute personnel by proportionate workload need but rather by proportionate time need. The criticism raised is that such an allocation plan must

involve a very refined collection system. One which has a much broader base of data (than ten weeks) to account for changes in the community environment and police policy procedure. If the goal is to provide a capability to plan based on prediction, a much more refined and comprehensive workload analysis must be undertaken.

The St. Louis Model. In 1964, Richard F. Crowther proposed a series of computer programs for the allocation of police personnel in St. Louis, Missouri.²⁹ These programs were subsequently refined and adapted to the St. Louis Police Department by Thomas McEwan.³⁰ The resource allocation project advanced the deployment process by incorporating two intricate and innovative techniques: prediction by exponential smoothing and assignment of response cars by queuing.

The St. Louis method is based on a demand for police services predicted by hour and geographic area, using projections based on past demand data with modifications for weekly and seasonal variations. The prediction method employs a statistical technique called "exponential smoothing" that takes into account variations in the call rate by time of day, day of week, week of year, and also adjusts for overall trends in the call rate (general increase or decrease compared to previous year). In effect, the exponential smoothing technique estimates future calls by "averaging" the volumes of calls experienced in past weeks, with the more recent weeks' data being given the most weight.³¹ The result is a predicted estimate of the number of calls to occur in any given area in each hour of the week. The service times of incidents are also smoothed in similar manner.

By making certain technical assumptions, the prediction model asserts that manpower can be distributed on the basis of urgent calls

having to wait in delay for a specific length of time before being serviced.³² This is described as a queuing delay. St. Louis allocates personnel based on the probability that, at most, 15 percent of each district's calls will be delayed in queue. This predictive function has produced a unique effect on conventional policing in St. Louis. Since the number of response cars is set so that less than 15 percent of all calls will incur a delay, it is necessary to split the patrol division into two entirely distinct functions--one to be concerned with answering calls for service (which comprises the majority of the patrol force), the second to perform crime prevention duties.

The St. Louis experience was the first major attempt to apply mathematical and probability modeling to the task of police manpower allocation. Although the exponential smoothing technique has been found to be adequately accurate, there are still several weaknesses that limit the overall procedure.³³

First, there appears to be no attempt to take into account "free" or "patrol" time of officers on duty. That time which could not be accounted for in elapsed time was "averaged" into the weekly estimate of demand. For this reason, it can be assumed that actual delays were much higher than those predicted by the computer programs. However, in the St. Louis experience, there was a noted excess of resources to keep the actual number of calls encountering a queue well under ten percent.³⁴ If such resources had not been available, then the total number of response cars would have necessarily been less, resulting in a higher percentage of calls incurring a queuing delay.

Second, the above situation highlights yet another problem. The St. Louis deployment method utilizes only one criterion within the mathematical technique to determine the required number of response cars; that being the fraction of calls that cannot be answered immediately by a police unit. The necessary assumption is that the estimated weekly demand follows a typical pattern over the hours of the week. This assumption can be challenged by modern crime specific analysis proponents.³⁵ Further, in order for predictions of criminal behavior to be effective in deployment, the predictions must be very delineated as to time and location. Techniques which are average or estimate general predictions about police workload and the total number of calls for service in a city are simply "not very helpful in the day-to-day deployment of police officers."³⁶

Third, the performance measure (or criterion) of percentage of calls delayed does not distinguish priority. All calls have the same chance of experiencing a queue. Such a design may well reduce the average response time to all calls but may indeed complicate the importance of a fast response to a specific call. The question arises, "Should a traffic hazard or barking dog call carry the same weight as a quick response to an armed robbery in progress?" In the St. Louis model, there is no way to distinguish among calls; a definite drawback to formulating dispatch policy.

Finally, and most important, the St. Louis technique (specifically exponential smoothing) necessitates the user to select one or more parameters that distinguish weight between old and new data. If patterns in the community and in the workload change rapidly, then an increase or decrease in police resources must also accompany the

change. The problem lies in continually monitoring and updating the computer program with respect to crime trends, community patterns, environmental factors, and police department policies and strategies. This can be extremely expensive and time consuming. Then too, the issue of old versus new data take on another aspect. What parameters will be used to account for these extraneous variables in the updating stage? Recognizing this fault, police administrators would be subject to constant political pressure as to the establishing of update criteria. By this time, the allocation plan would be so complex and so refined as to detract from its original purpose. Few departments would be able to justify the cost in terms of gathering, analyzing, and implementing such a deployment plan.

The LEMRAS Model. LEMRAS is an acronym for Law Enforcement Manpower Resource Allocation System. It was developed by the IBM Corporation and based on the St. Louis System. The program is available for lease to police departments, and several large cities, including Philadelphia and Los Angeles have implemented the system.

The LEMRAS method and the St. Louis model are the same except that the LEMRAS program establishes a manner in which calls are serviced by priority. Calls for services are divided in a large number of event codes. These codes are then assigned into one of three priority levels which designate the length of time the call will be held in queue. For example, a "cold" burglary may be placed in priority three while a robbery in progress is assigned a priority one. Calls are then dispatched in order of decreasing priority. Thus, all priority one and two calls would be dispatched before any

priority three call; thereby decreasing the delay time for any high priority incident.

Being so closely related to the St. Louis model, the LEMRAS program offers essentially the same benefits and suffers from the same limitations.³⁷

Simulation and Travel-Time Models. In 1967, the work of the Science and Technology Task Force of the President's Commission on Law Enforcement and Administration of Justice marked a major advancement in the application of technology and operations research to problems of criminal justice.³⁸ Recommending that operational problems for police agencies (such as efficient police patrol allocation) be analyzed from a quantitative point of view, the Task Force called for the use of sophisticated computer techniques, analytic probability models, and intricate engineering methods.

As a result, Richard Larson, from the Massachusetts Institute of Technology focused on the quantitative prospects of analyzing urban police patrol. In 1969, he designed a program similar to LEMRAS, however, much more sophisticated and refined.

The simulation model is based on an allocation of manpower by travel time. Larson prioritizes the expected time of travel to a crime based on the relationship of geographical characteristics, number of patrol units, and the demand and service rates of calls.³⁹ By using heuristic programming algorithms, a very sophisticated model is produced to search for optimal response times and areas. A simulation model is then employed to investigate the implications of complicated allocation and deployment tactics. The simulation model works in the following way:

Incidents are generated throughout the city, randomly in time and space. Each incident has an associated priority number, the lowest numbers designating the more important incidents. As each incident becomes known, an attempt is made to assign (dispatch) a patrol unit to the scene of the incident. In certain cases this assignment cannot be performed because the congestion level of the force is too high; then, the incident report joins a queue of waiting reports. The queue is depleted as patrol units become available.⁴⁰

Larson's use of random patrol positioning is based on the assumption that random crime occurrences are evenly distributed over a given rectangular sector, and that the position of the patrol unit and incident of the call are independent. His expected travel time $E(Tr)$ to the call is:

$$E(Tr) = 1/3 \left[\frac{X_0}{V_x} + \frac{Y_0}{V_y} \right]$$

where: $E(Tr)$ = travel time

X_0 = width of sector

Y_0 = length of sector

V_x = effective travel speed to the east-west direction

V_y = effective travel speed to the north-south direction⁴¹

Thus, Larson's program is similar to LEMRAS, except that more than three priority levels are permitted and an average length of time a call in each priority level will wait in queue is calculated.

There are two major advances over LEMRAS that Larson's model proposes. First, the program is very flexible to accommodate almost any set of priorities and/or dispatching policies. Second, the simulation model is based on an algorithm which considers a number of performance measures other than just queuing delays. Larson discussed a variety of performance

measures that could be considered, but the actual ones included in his program were:

- . Average travel time to incident
- . Average patrol frequency (how often a car passes a random point in the precinct while on preventative patrol)
- . Patrol hours outside of elapsed time or "preventive" patrol time⁴²

At first glance, Larson's model can be viewed as a major step in allocation design. Since the simulation technique is extremely flexible, outputs on a variety of interests may be obtained, including policy and management issues. However, in exploring the program in closer detail, several fundamental weaknesses are observed.

Larson bases his simulation and travel time models on the assumptions that (a) crime occurs randomly, (b) the probability of space-time coincidence of crime and patrol is a quantifiable and influencing value, and (c) crime occurrence and patrol are independent. Unfortunately, these assumptions are rarely met. Proponents of crime specific analytic techniques argue convincingly that crime does not occur randomly.⁴³ Additionally, it has been shown by directed patrol techniques that the position of a patrol unit and incident of a call are not independent.⁴⁴ Consider the recent initiatives of the Law Enforcement Assistance Administration regarding patrol research. These studies, to include the Patrol Emphasis Program (PEP), the Integrated Criminal Apprehension Program (ICAP), and Managing Patrol Operations (MPO), support the theoretical argument that crime does not occur randomly; that it follows specific patterns and trends which can be plotted.⁴⁵ Hence, the crime analysis techniques for directed patrol, saturation patrol, task forces,

etc. Capturing the essence of crime analysis and the fundamental argument that crime does not occur randomly, William G. Gay writes:

Crime analysis is the process of systematically examining recent crime incidents and criminal behavior in an effort to identify crime patterns and characteristics so as to permit the effective deployment of personnel and resources and the adoption of appropriate strategies and tactics.⁴⁶

Another distressing point in Larson's model is his emphasis on gaming theory. Being one of the first mathematical models to propose the prevention of crime through uniform patrol, he equates the probability of deterring or intercepting a crime in progress to the probability of a crime occurring. This concept necessarily implies that preventive patrol is directly proportional to the frequency of crime occurrence, an assumption that is not clearly demonstrated. For example, Richard Krouger's study on randomly moving patrol cars in Houston, Texas, suggests that the probability of a police unit deterring a criminal act, given a specific location, is significantly reduced when compared to the same police unit remaining in a stationary position.⁴⁷ Then too, the controversial study conducted in Kansas City in 1975 concluded that regular patrol of the streets by uniform police in marked vehicles may not prevent crime.⁴⁸ It is interesting to note, that Larson responded to the Kansas City experiment; again attempting to employ "probabilistic models . . . to estimate frequencies of preventative patrols and response times."⁴⁹ His critique was severely damaged by his use of faulty assumptions (previously mentioned). Tony Pate, George L. Kelling, and Charles Brown emphasize this point when they write, "Larson's models nor his data are adequate to make statements about typical patrol intensities.

in major American cities."⁵⁰ They base this strong statement on a lengthy dissertation concerning the criticism of Larson's travel time model and simulation-probability model.

In conclusion, since Larson's program is similar to LEMRAS, it requires the continual updating of environmental, community, and departmental factors to assess predictive trends. A procedure which may be very costly and time consuming.

PCAM - Patrol Car Allocation Method. The patrol car allocation method (PCAM) is a computer program designed to enable police departments to determine the number of patrol units to have on duty during various times of the day. It is based heavily on Larson's program, with substantial improvements. The program was developed jointly by the United States Department of Justice and Housing and Urban Development in 1975. Its capabilities are described in the users manual by Jan Chaiken and Peter Dormant.⁵¹

PCAM is a simple analytic model. It provides two patrol performance objectives--dispatch delay and response time. For this reason, it is frequently referred to as a performance-oriented system.

PCAM is significantly different from previous programs in that it does not attempt to equalize the calls for service workload across watches or shifts. Instead, its goal is to deploy officers so that dispatch delays and response times (performance monitors) can be optimized. PCAM has both descriptive and prescriptive capabilities. It is very flexible and can specify particular allocations that best meet the standards of performance established by individual users. When operated descriptively, an evaluation of current patrol allocation can be assessed against the user-set performance indicators.

When operated prescriptively, the program will recommend the "best" temporal allocation of existing resources. The "best" allocation plan can be defined by setting parameters for geographical commands, different times of the day or week, average number of calls placed in queue, and the total dispatch and response times.

Unlike the simulation model proposed by Larson, PCAM is not based on a randomly-moving patrol car assumption, nor does it hold constant specific probability and gaming functions. It is almost entirely controlled by user input and user designation of performance monitors. The natural limitation is contained in the number and type of parameters available. For instance, the model reflects no geographical structure and is insensitive to the locations of patrol cars within a specific area. Also, differences in crime rates, call for service trends, and patrol densities are not easily augmented to the program. For this reason, continual updating requires the user to write subsidiary computer programs; a costly and time-consuming procedure. Further, PCAM maintains a simple dispatching model and is severely limited to policies and guidelines which can be implemented. As an example, PCAM fails to allow dispatching patrol cars across command boundaries for high-priority calls.⁵² A procedure which is quite common and many times imperative in police deployment plans.

The Shoup-Dosser Model - The Split Force Concept. Stemming once again from the President's Commission on Crime and Law Enforcement in 1967, the Chicago Police Department, under the leadership of O. W. Wilson, received an operations research grant to review uses of manpower in the patrol division. The result was an exhaustive project in the Chicago Police Department which demonstrated the relevance and

potential value of a number of specific approaches.⁵³ The two models proposed for the allocation of police resources and, that are relevant to this study, involve the Shoup-Dosser model with the Split-Force concept.

The principal author of this approach is Albert Bottoms, who directed the Operations Research Task Force of the Chicago Police Department.

The Shoup-Dosser model was first proposed in 1964 by Carl S. Shoup and Douglas Dosser.⁵⁴ The model assumes that the city is divided into two districts with corresponding average crime rates Z_1 and Z_2 . Further, it is assumed that the effectiveness of a patrolman is different in each district and that constant numbers K_1 and K_2 are defined to accommodate these differences. If t policeman are assigned to district one, they will have effectiveness $t K_1$. The larger $t K_1$, the greater the effectiveness of the t policeman in police district one. The goal of police allocation is assumed to increase the effectiveness of $t K_1$. Further, it is assumed that when t policeman are assigned to district one, the average crime rate is reduced to $Z_1/t K_1$. Thus, the total average rate (under the two district assumptions) for the city is:⁵⁵

$$\frac{Z_1}{t K_1} + \frac{Z_2}{(T-t)K_2}$$

where: T represents a total number of patrolmen

Z_1 and Z_2 represent average crime rates

K_1 and K_2 represent effectiveness in two police districts

t represents number of policemen assigned to each district

Of course, a much more refined and complicated model is produced by Bottoms to distribute T policemen over a city with many police districts. However, for the purposes of this study, the simpler equation is adequate to explain the model.

Assuming that police officers have a quantifiable and direct affect on the crime rate within a specific district, the model proposes a split-force concept. The ideal objective is to have (at any given moment) the exact amount of response force needed to match the demand for police service; and simultaneously have a preventive force throughout the city in such a way as to minimize total criminal activity.⁵⁶ Thus, the patrol force is split into response and preventive duties.

The Chicago experience with the Shoup-Dosser Method can be highly criticized on a number of theoretical points. Several assumptions are made which are not clearly proven. First, the assumption that preventive uniform patrol has an effect on crime is speculative at best. The Kansas City Preventive Patrol Experiment, as well as other recent studies, indicate that uniform patrol may not alter crime activity in a given district.⁵⁷ In furtherance of this issue, the Shoup-Dosser model proposes that an increase in patrol capability alone directly decreases crime. Once again, the Kansas City Preventive Patrol Experiment challenges this contention.⁵⁸ However, the largest fault in the model centers around the division of a city into separate districts wherein police productivity is measured in terms of arrests and the recovery of stolen property.⁵⁹ The model assumes that patrolmen are equal in performing this productivity measure and, therefore, "equal in effectiveness from man to man."⁶⁰ This

assertion is not founded in the literature. Contrarily, a number of studies suggest that police behavior, as measured by either clearance rates or arrest rates affect the crime rate independent of other social factors. In 1974, Tittle and Rowe found that the higher the clearance rate the lower the total index crime rate.⁶¹ While this study was conducted only among cities and counties in Florida, it certainly indicated that individual police style may effect crime. In support of this study, Charles Logan analyzed the relationship between clearance rates and reported property crimes for five consecutive years. He concluded that an inverse relationship existed.⁶² And finally, in a more comprehensive and detailed study, James Q. Wilson and Barbara Boland investigated the effect of police practices on the rate of robbery in 35 American cities.⁶³ They concluded that statistical evidence supported the premise that individual police behavior may affect crime rates. They state that "police may affect crime rates less by how many of them are on patrol than by what they do there."⁶⁴ This is in direct conflict with the Shoup-Dosser model which asserts that a direct increase in the policeman will result in a reduction of the average crime rate.⁶⁵

The Hypercube Queuing Model. The hypercube queuing model is one of the latest and most advanced computer programs currently used in police deployment today. Developed in 1975 by Richard Larson, it provides police managers with assistance in the design of individual patrol beats.⁶⁶ The goal of the program is to provide information about the ability of a patrol unit to answer service calls in various patrol beats. Unlike traditional beat concepts where patrol units answer calls only in assigned areas (except for emergencies), the

hypercube design explores different aspects of dispatching strategy. The program does not construct beat boundaries. Rather, it calculates performance measures for various beat designs and, constructs hypothetical structures which match departmental parameters or needs. The model is currently in use in Boston, Massachusetts.

The hypercube program is not a simulation. It solves a set of specific queuing equations that determine the steady-state probability that any particular set of patrol cars is unavailable to be dispatched, while other units are available.⁶⁷ In effect, the model solves a finite set of equations based on the numerous possibilities of different patrol units being unavailable for service calls. Further, the program determines a number of outputs based upon these probability approximations, such as (1) equal workload among units, (2) equal response times and travel times among units, (3) minimum dispatches outside a beat, and (4) patrol frequency within each beat. Obviously, a prerequisite to the use of hypercube modeling is a jurisdiction which is divided into numerous reporting units.

The hypercube queuing model has a sound conceptual and mathematical base. As previously stated, it is not a simulation model but produces calculations which are steadystate. This quality does initiate a few drawbacks. First, the number of patrol cars must be a fixed and constant number for each run of the program. Second, the program is limited in addressing emergency and high priority calls for service as the total number of units available at any given period of time changes with reported activity. And third, being in a steady-state, the hypercube model cannot reflect changes in call rates, environmental factors, and other characteristics over time without

being reprogrammed. This updating feature can be costly and time consuming.

Deployment Plans in General. The preceeding overview has attempted to familiarize the reader with an historical evolvement of police patrol allocation models. No claim is made that all of the published allocation designs have been scrutinized. In fact, only those studies and models which are well known and frequently cited have been analyzed. There are numerous other designs which are rarely mentioned in the literature. For example, the St. Louis model has initiated a spatially distributed queuing model; the methods proposed by Larson have been segmented into an interactive approach and several other probability methods; and the hypercube design has even been altered into a program called "superbent."⁶⁸ For the most part, these other models have not been extensively used nor cited in the literature. For this reason they are placed in a footnote for the purposes of this study.

One of the pronounced shortcomings of police patrol allocation designs, in general, lies in the area of evaluation. For the most part, the evaluation of patrol deployment plans have not been well developed and have failed to make use of experimental design.⁶⁹ What is required to further the advancement of patrol deployment is a carefully designed experiment that measures the effect of innovations in police strategies and schemes. For example, very few of the noted patrol allocation designs have even been implemented to measure what the police actually did.⁷⁰ Instead, they attempted to measure the effect of increased or decreased response times, elapsed times, police presence, workload, calls for service, etc. Further, it is only

recently that scientists are reviewing and critiquing patrol allocation plans based on the problems of what policemen actually do. Gary W. Cordner offers an excellent advance in this direction as he explores police patrol workload studies from an analysis of the police role.⁷¹ He identified a major shortcoming of the workload studies based on the ambiguous nature of the patrol task. Not only do police spend about 50 percent of their time on free patrol (which is usually ignored by allocation studies), but the effect of this free patrol as a preventive measure is rarely discussed in terms of self-initiated activity.⁷² The writer agrees with Wilson, Boland, Cordner, and others who suggest future patrol allocation designs focus on the "subjective meanings" of patrol activities and the "capability of individual police behavior."⁷³

Statement of the Problem

The state-of-the-art in patrol deployment design has progressed in a step-by-step manner. First, utilizing command discretion, intuitive judgment, and rather simple analytic techniques in the early 1950's; to more advanced procedures using computer applications in the late 1960's; to finally the total use of computer programming, probability modeling, and beat designing in the late 1970's. Throughout this evolution of allocation models, there has been a consistent set of limitations when applied to the needs of small urban centers.

First, the noted allocation designs have not addressed the issues of small cities. They have historically been designed for large urban centers, such as Los Angeles (hazard formula), St. Louis (LEMNAS), Chicago (Shoup-Dosser), and Boston (hypercube queuing). These highly

technical and computerized mathematical models have failed to address the special needs of managing police in small urban centers--political jurisdictions that account for 93 percent of the police departments in the United States.⁷⁴ For example, small urban cities are often characterized by unique local conditions such as cultural norms exhibited in the South; or public expectations of political leaders and government institutions; or particular economic capabilities of wealthy suburban centers in the East.⁷⁵ This often means specific idiosyncrasies for each small community that must be addressed in the police allocation design. For instance, the police may provide funeral escort service for their community. Although this might not be a high priority service for patrol deployment, nevertheless, it can be an important element for decision-making in that jurisdiction. Failing to perform this service adequately might have negative political and economic consequences when the police manager makes budget requests. In contrast, for the large metropolitan city, such a service is usually not an issue.

Secondly, this lack of attention to unique local conditions inhibits the use of current programming-type allocation models, such as LEMRAS, simulation, PCAM, and hypercube queuing. A documented disadvantage to each of these models is the failure of the program to readily adapt to a changing environment. A new city policy, a sharp economic decline, a quick political turnover, or even a timely police raid could drastically alter the predictive functions and workload assessments of these sophisticated allocation models. Therefore, continual evaluating and updating of the program is required. Many times, this task is very difficult as subsidiary programs must be

written. Then too, the community is always changing, causing different demands, and affecting current workload patterns.⁷⁶

This issue is related to still another problem. While the recent literature advances computerization as an affordable item for small cities, there is a critical limit to the expense of operating such a resource.⁷⁷ Surely, the continual monitoring and adapting of various programs to environmental changes may exceed such a limit. And then again, due consideration must be given to not only the monetary output but also to the exhaustive time consumption needed to fulfill such demands. Given these costs, it can be strongly argued that such computer deployment techniques for urban police forces of less than 150 sworn persons is not economical and may be dysfunctional.⁷⁸ The continued input of highly technical data for queuing and probability models may be too sophisticated and too expensive for the manpower deployment needs of small urban police departments.

Further, most small urban police administrators have not been trained to think in terms of probability factors, queuing models, or computer simulation techniques. Often the progeny of 20 years longevity within a civil service system and having little formal education, the small city police manager frequently views these allocation designs as too complex and largely irrelevant to his needs.

Finally, the large urban police allocation designs have not been comprehensive; centering only on the deployment of uniform patrol without adequately considering the allocation of personnel to other police duties (i.e. investigation, supervision, etc.). The fiscal restraints faced by most small urban police departments require deployment models that consider the effective and efficient use of all field officers.

Thus, the current available manpower allocation models have not met the specific needs of small urban centers on several points. These are: (1) the designs are too complicated and require costly updating needs; (2) they are not comprehensive; (3) they fail to accommodate unique and changing community conditions; and (4) the allocation models do not address the local, decision-making elements present in small cities.

This dissertation addresses this important problem by developing a decision-making method for the determination of optimum police patrol allocation design for urban centers having less than 100,000 population. This method will not emphasize prediction of calls for service or probability calculations to determining patrol strength given certain criteria. The deficiencies of these mathematical models have already been discussed. Rather, the focus of this study is on a method for combining decision-making elements that will permit a police manager to select and use certain criteria to equalize the workload of patrol units and to assess alternative methods for achieving optimum allocation design.

In addition to this practical contribution to the science of police management, this study has theoretical implications regarding the decision-making process in police organizations. By directly applying decision-making theory to the "real-world" problem of police manpower allocation, a new and innovative managerial technique will be proposed. This also will serve as a source to direct inquiry for future study.

Review of the Literature

The literature dealing with decision-making in the police management field is not extensive, and most of it devoted to methods of applying the decision-making process. While in theory it should be easy to divide decision-making processes into discrete, conceptual paradigms, in reality, it is extremely difficult to separate one approach from another.

Further, there are as many definitions of decision-making as there are organizational theorists in the various disciplines. To overcome this difficulty, a definition of decision-making has been chosen from the many that have been formulated that permits decision-making to be viewed as a dynamic and complicated process. That definition, offered by Ira Sharkansky, is: "a process in which choices of alternative courses of action" shape a desired outcome.⁷⁹ It contains several concepts that are directly related to the general study of police management and the making of such specific decisions as patrol allocation: (1) decision-making is a process; (2) decision-making involves the ability to make rational choices; (3) decision-making assumes a systematic methodology; and (4) decision-making is conducted by human beings attempting to achieve a desired consequence or result. These concepts (which are presented in their general order of historical evolution) provide an analytical approach to reviewing the literature.

Decision-Making as a Process. Sam Souryal has identified a pattern that he calls "the microdynamics of decision-making."⁸⁰ Accurately displaying decision-making as a purposeful process which requires intentional thinking, Souryal places extreme importance on

three sub-systems: desireability, predictability, and probability. Drawing the essence of his approach from Irwin Bross' design on integrating past data with future outcomes, Souryal expresses that his microdynamic model is the most useful in the absence of a mathematical model; and he assumes that no mathematical model exists.⁸¹ However, this conflicts with probability models and simulation methods used in operations research and by systems science (discussed later in this chapter). Even Bross' study is a structural model providing some technical data for administrators.⁸²

While Souryal uses a contemporary policy analysis approach to develop a continuous process capable of providing the manager with insight into future outcomes, he fails to elaborate on the technology necessary for useful predictions. From a strict policy analysis viewpoint, the process of decision-making should be concerned with describing historical patterns, explaining them, and developing recommendations as to which patterns are desirable and how they might best be achieved. Further, and closely related to Souryal's predictive approach, a decision-making method should be an intellectual response that explains and describes the causes and consequences of administrative action with a heavy emphasis on the exploration and discovery of new, innovative alternatives to solutions. These are not new concepts; Yehezkel Dror has been discussing policy-making and decision-making from a prescriptive point since the 1950's.⁸³

However, in support of Souryal's and Bross' concepts, a refreshing underlying theme emerges from the continual dialogue on "predictive techniques." While not openly stated, the models intimate that decision-making is more than just following the numbers of plugging

values into some mysterious, predictive formula. Decision-making is not only a cognitive process, it is an art. And as so eloquently described by Aaron Wildavsky, decision-making, like policy analysis is an imagination, a "thought experiment" that attempts to recognize future contingencies in order to improve what may come to pass.⁸⁴ Further, decision-making is prognostic. Inherent in the process is the ability to perceive future consequences of actions taken.⁸⁵

Here then, is the essence of decision-making as a process; as a continuous, dynamic, imaginative and intuitive procedure aimed at understanding historical patterns, grasping current situations, recognizing decision consequences, and perceiving future events.

Decision-making and Rational Choices. Considered the most idealistic design developed in the area of decision-making, the rational or normative model concentrates on the individual ability to reason or compare alternative means to an end.

Herbert Simon explains that rational choices are made on a "principle of efficiency."⁸⁶ His famous model of rationality contends that there are three essential steps in decision-making; (1) list all of the alternative strategies, (2) determine and calculate all of the consequences to each strategy, and (3) evaluate all of these consequences in a comparative fashion.⁸⁷ While Simon is given credit to the development of this approach, its comprehensive expansion can be observed in the literature of several other well-known theorists. Peter Drucker's concept of the "Effective Executive," N.F. Iannone's "style" in Supervision of Police Personnel, and Sharkansky's development of Public Administration all exhibit an expansion on Simon's original work.⁸⁸ The rational model, now often

referred to as the rational-comprehensive model in the above standard works, sets forth a series of formalized steps toward "effective" decision-making. These steps can be generally observed in each of the cited studies and listed as follows:

1. Identify and define the problem
2. Ascertain all information regarding the problem
3. List all possible alternatives and means to solving the problem
4. Analyze the alternatives and assess the facts
5. Select the appropriate alternatives; find the answer.

It is obvious to observe the elaboration on Simon's original method in each of these cases. The decision-making approach assumes an ideal condition whereby the decision-maker is aware of all available information related to the problem and has an unlimited amount of time in which to explore and narrow down proposed alternatives by a "rational" and comparative process. Unfortunately, the real world rarely allows for the ideal.

Therefore, highly criticized for being too idealistic and irrelevant to the administrative functions of a police organization, the rational decision-making model has been subjected to harsh theoretical reviews. Interestingly, many of these criticisms were noted as limitations by the proponent in the original method. For instance, Sharkansky provided a detailed discussion of "road blocks" to the fulfillment of the rational-comprehensive model in practical administration.⁸⁹ He documented constraints in the collection of all available data and emphasized contingencies in the human ability to make decisions. Additionally, Simon elaborated on the concept of a "rational man." Noting that man was "bounded" by a triangle of limitations, he stated:

On one side, the individual is limited by those skills, habits, and reflexes which are no longer in the realm of the conscious . . . on a second side, the individual is limited by his values and those conceptions of purpose which influence him in making decisions . . . and on a third side, the individual is limited by the extent of his knowledge that is relevant to his job.⁹⁰

It is apparent that Simon not only understood the decision-making process but also the "human" factors associated in the term "rationality." A prerequisite to "effective" decision-making is an acute awareness of the social, environmental, and organizational demands placed on the administrator. Simon accurately stresses that man's ability to make rational decisions is bounded by the limitation of his knowledge of the total organization.⁹¹ From this critical observation, he formulates a modified rational-comprehensive idea entitled, "bounded rationality."⁹² The emphasis, of course, is on man's inherent limitations to make decisions.

Another approach concerning the modification of rational decision-making is "incremental" and "muddling through" theories explored by Charles Lindblom.⁹³ Based on his study of governmental institutions in the United States, Lindblom states that the decision-making process is so fragmented and so complex, incorporating the interaction of various institutions, political entities, pressure groups, and individual biases that rationality can have only a marginal or "incremental" affect. Lindblom asserts that decision-making is serial, that it is limited by time and resources, as it gropes along a path where means and ends are not distinct, where goals and objectives are ambiguous, and where rationality serves no purpose. Contending that managers and administrators "play things safe" and opt to move very

slowly (incrementally) in decision-making, Lindblom proposes that managers "muddle through" problems rather than analytically choose decisions.⁹⁴ Lindblom's ideas have support, if not in theory, at least in practice, as many police managers find them to be "a description of reality."⁹⁵

Thus, the decision-making method has been proposed by Simon and others, and to some extent even Lindblom, to be a process of choice based on a rational comparison of alternatives. Highly criticized for being too ideal, they ironically provide the basic theoretical foundations for the third set of models to be studied--those involving a systemic approach to alternative measures.

Decision-making Assumes a Systematic Methodology. Introduced in the early 1950's as "general systems theory" by Ludwig Von Bertalanffy, his model emphasizes a system which maintains a constant state while the surrounding environment is changing (so-called dynamic equilibrium).⁹⁶ Using any living organism as an example, Bertalanffy's concept is based on "organization and wholeness" in the accomplishment of a number of goals.⁹⁷ The important aspect of the early systems approach is that it conceptualizes a system as a static entity. In this sense, an "organism" or an organization is represented as a self-maintaining structure, one which can reproduce. Such an analysis hints at the type of framework useful as a systems theory for decision-making one which is developed as a system of systems and that can focus attention at the proper points in the organization for rational maneuvering, both from the standpoint of the organization and the environment.

Anthony Wilden provides an exceptional categorization of the systems approach in which the non-developmental, structure maintaining, and consistent system is labeled "homeostatic."⁹⁸ Wilden's typographic label implies a sequential stepping of events between organization and environment in which change occurs linearly and independently.

The scientific-management movement of the early 1960's utilized the concept of the man-machine system (cybernetics) to re-emphasize the organization and the environment as separate distinctions, dependent on a static interplay for goal achievement. It was not until Magorah Maruyama's classic call for a second cybernetics, in 1963, that the concept of "mutuality" was introduced.⁹⁹ His profound idea initiated an altering interaction between organization and environment, or an action/reaction exchange. It was at this point that the concept of system with environment versus system in environment became apparent.¹⁰⁰

This conceptual change resulted in a relatively widespread re-evaluation of managerial approaches and decision-making techniques. Recognizing the ideal organization must act "in harmony" with the environment, proponents such as Daniel Katz and Robert Kahn shifted the focus of system science to the organization as an open-ended, social sub-system.¹⁰¹ The concept studied the organization from within, as a social device for efficiently accomplishing, through group means, some stated purpose. Hence, the social-system school evolved from two independent participants (the organization and the environment), to the study of interpersonal relationships, human behavior, and informal/formal patterns of organization within an environment. Moreover, this

organization or enterprise was recognized as subject to external pressures from the cultural, economic, social, political, and physiological surroundings. In effect, the theoretical concerns of the systems approach asserted that any organization could be studied as a distinct subsystem, within the social structure of society, having a specific function and objective.¹⁰²

Relating this approach to law enforcement agencies, the police system can be viewed as a part of an integral set of components that work together for an overall goal.¹⁰³ It is a part of a larger environmental system.

In this sense, the systems approach is similar to the rational model previously described as they both contend:

1. There is a lack of agreement regarding the objectives of the police system (especially concerning manpower allocation).
2. There is a lack of knowledge of alternative means for accomplishing goals, either within or outside the system.
3. There is a lack of agreement defining the criteria of performance, and;
4. There is a lack of knowledge of transfer functions which would enable the prediction of outcomes from any given set of inputs.¹⁰⁴

Basically, the systems approach is a derivative of the rational-comprehensive model. It is a framework for complex problem-solving, emphasizing hierarchies of systems and their inter-relationships. For the most part, the systems method attempts to define objectives and give some sense of order or structure to the solving of problems aimed at accomplishing those objectives.

A system can be defined as a set of objects and all the relationships that exist between the objects. All systems are composed of sub-systems and are members of a higher system.¹⁰⁵ For example, the police system is in part, a member of the criminal justice system, which is a part of the social system of America within which our societies exist. The police system, in turn, is a set of sub-systems.

Following World War II, the systems approach segmented into a technique vastly influenced by large, complex systems of variables. The application, collection, and analysis of data for decision-making within the organization was called "operations research."¹⁰⁶ In response to a need for a management-science which addressed complex problems involving many variables, such as government planning, military spending, natural resource conservation, and national defense budgeting, operations research employed the use of mathematical inquiry, probability theory, and gaming theory to "calculate the probable consequences of alternative choices" in decision-making.¹⁰⁷ As a result, techniques such as Program Evaluation and Review Technique (PERT) and Planning, Programming, and Budgeting Systems (PPBS) were developed for use in managerial planning, forecasting, and decision-making.¹⁰⁸ By their very nature, these techniques must structure the system for analysis by quantifying system elements. This process of abstraction often simplifies the problem and takes it out of the real world. Hence, the solution of the problem may not be applicable in the actual situation.

PERT and PPBS are managerial attempts to convert the disorganized resources of men, machines, and money into a useful and effective enterprise by which alternatives to problem-solving can be assessed.

This process is conducted by a cost-effective analysis or an estimation for each alternative of the costs that would be incurred and the extent to which the objectives would be attained.

This approach is again, a highly sophisticated elaboration of the rational model utilizing quantitative techniques in the cost-effective relationship. The weakness of the method is in its practicality to real world situations where time and resources are not directly structured to gather intelligence about every problem and possible alternative. Further, it also assumes that human biases will not enter the decision-making process. The most critical aspect of the approach appears to be in its overriding insistence that decision-making is not a human activity but the product of some scientific, computerized and unimpressionable robot that digests quantitative information in return for "calculated responses."

Aaron Wildavsky has continually warned that the application of decision-making to costs, benefits, resources, and budgets frequently formulates the adoption of meaningless data and places an unwarranted stimuli into the process.¹⁰⁹ The danger may be that decision-making might decrease its intellectual content at the expense of practical impact.

The last decade has produced a significant change in the systems approach to management and decision-making. Stemming from the human relations concept, the new systems literature centers on explaining both the behavior of organizations and the behavior of people within organizations amid a changing environment. The shift from large, complex organizations and systems to small groups is noted in the

plethora of studies aimed at improving managerial style and technique. Sensitivity training, interaction modeling, leadership profiling, group dynamics, communication workshops, motivation therapy, and job satisfaction studies are all relatively recent contributions to this body of knowledge. The goal of this human relations perspective is to harmonize the organization with the objective and methods of managerial decision-making. Hence, the application of theories and perspectives advanced by Etzioni, Likert, MacGregor, Drucker, Argyris, Odiorne, Shein, and Katzell address managerial and decision-making behavior within the organization.¹¹⁰ Although these bodies of knowledge are worthwhile contributions, they have not provided a lasting solution to the continuing disparity between satisfaction and acceptable organizational experiences on the one hand and rapidly changing environmental conditions on the other. Today's managers and decision-makers must attempt to balance these internal and external conditions. Warren Bennis captures this thought in his work on adapting to change.¹¹¹

This tenuous concept of the "organization in a state of ferment" has led to a new level of decision-making ability--the concept of learning through environmental evolution.¹¹² The literature in this area lends itself to the planning process as described in Gregory Bateson's work.¹¹³ He formulates a series of developmental steps in which the process of change is adapted to through individual learning. Edgar Dunn takes this concept of learning by evolution and moves beyond the individual and organization to the overall system.¹¹⁴

Implying a much higher degree of complexity to his model, Dunn states that learning through change is not linear or serial. Instead, he proposes that new behavior, new structure, new rules, and subsequently new conditions arise from pre-existing ones through a process of transformation.¹¹⁵ The important element of Dunn's model can be seen in its comparison to earlier systems approaches. Dunn's "transformation" concept emphasizes that systems are not static (as compared to Wilden's classification of homeostatis and sequential stepping of events). According to Dunn, the organization and the individual survive by their ability to adapt and evolve within the social system. Learning is inventive and creative on the part of human beings; it is a cognitive ability for modifying present conditions under changing circumstances.¹¹⁶

This concept is elaborated on by Friedman, Michaels, and Schon who contribute to the theoretical argument of social learning by focusing on real world examples.¹¹⁷ Friedman's study on the role of the planner in a mutual learning transaction with clients superficially touches the real processes by which organizations, institutions, and societies transform themselves within a changing environment. Michaels concept of planning and change addresses this issue in much more detail. Emphasizing that shifts in social norms and structures (as well as technological innovations) require change in personal, interpersonal, functional, and managerial aspects of organizational life; Michael advocates the implementation of "long-range social planning."¹¹⁸ From a theoretical point, Michael expands on Dunn's concept of organizational transformation. Noting that social shifts have historically been reactive, unanticipated, and

uncontrolled, Michael proposes a plan for "directed self-transformation" for the organization and society.¹¹⁹ Michael views his learning process as a societal movement toward learning how to adapt to change.¹²⁰ Basically, he proposes a reciprocal concept between organizational and environmental learning. The organization learns how to change with the environment as the environment is adapted to accommodate the organizational change. Through mutual feedback, in times of uncertainty and turbulence, Michaels stresses that change in structure and norms can occur "so as to make the consequences rewarding" for both the environment and the organization.¹²¹

Donald Schon argues that the organization must become "a learning system" decentralizing control and abandoning pragmatic models of planning.¹²² Contending that institutions and organizations respond to the threat of change by stagnate reluctance or "dynamic conservatism," he proposes that strategic learning, intervention, and forecasting be employed so that necessary action can be taken to allow for future contingencies.¹²³ Schon views the world as a dynamic, turbulent environment threatening public and governmental institutions who refuse to change. His solution is not in adaptation, like Michael, but is based on the structural change of institutions to define themselves in terms of "functional systems."¹²⁴ In this manner, specificity is lost and the linking of previously separated components is achieved, thereby, producing new "networks."¹²⁵ It is under the pressures of change that these "networks" are forced to rely on each other and subsequently become learning systems to facilitate the decision-making process.

Although criticized for being unsubstantive and failing to address a specific and qualitative goal in future planning; the works of Friedman, Michael, and Schon offer a different perspective to the traditional systems approach to decision-making. They establish new vistas which involve the individual as a integral part of the organization to cope with change. It is the emphasis on the individual which highlights the final point in this literature review.

Decision-making is a Human Attempt to Attain Goals. In an opposing concept to rationality and logic, William Gore identifies the crucial element of humanism in decision-making. He presents a "heuristic model" appropriately referred to as "the gut level approach" when considering the police organization.¹²⁶ The seasoned patrol officer frequently refers to an unknown quality or phenomena known as "mocksie" or the ability to be "street-wise." This unknown dimension is captured in Gore's decision-making method for administrators. In an antithesis to the rational model, Gore provides a mechanism by which a decision is the product of the maker's personality. In a quotation from his book, Gore views the heuristic process "as a groping toward agreements seldom arrived at through logic . . . the very essence of those factors validating a decision . . . are internal to the personality of the individual instead of external to it."¹²⁷ While the rational method is concrete, formalized by structure and calculations; the heuristic concept is nebulous, characterized by "gut feelings reaching backward into the memory and forward into the future."¹²⁸

Applauded for its contribution to the decision-making process, Gore's approach is also highly criticized as being too simplistic and

non-scientific. Sam Souryal writes that "Gore's analysis is too unreliable . . . it could complicate existing situations, promote spontaneity, discredit the role of training, and delay the advent of professionalism" in police organizations.¹²⁹

This is an unfair assessment of the method. Gore views heuristic applications as adjuncts or alternatives to rational models. Further, some type of credibility must be assessed to that vague, unknown, and non-measurable entity we call "experience," "talent," or the "sixth sense." It was this element that Simon had so much trouble with in calculating his "bound and limited" argument regarding the rational model. In any event, Gore's contribution remains as a paradoxical antinomy to decision-making based solely on figures, formulas, and mathematical designs.

The last decade has seen the emergence of yet another aspect toward heuristic decision-making. Research on commissurotized brain patients (those whose brains have been surgically split) has received considerable attention in the psychophysiology literature. The issue being raised concerns the delineation of brain hemispherical functions in relation to intuition. Roger Sperry's experiments infer that there are two distinct, information-processing systems respective to each brain hemisphere. He states that "there appears to be two modes of thinking, verbal and nonverbal, represented rather separately in left and right hemispheres, respectively."¹³⁰ Michael Gazzaniga elaborates on this distinction by studying cross-linguistic and interference of one hemisphere to the other.¹³¹ When the right side responds to a task unknown by the left and the left is asked why the response is made, it often guesses. It needs a reason for

behavior--reason does not always direct behavior but reality is interpreted and rationalized after the fact based on responses to it.¹³² Since the right hemisphere does not have language, it is suggested that intuition may be the non-verbal knowledge of the right promoting acceptance or rejection of the data of the left.¹³³ What is known about the right hemisphere is not conclusive. However, the concept that it may derive at an answer to a question from a wider, more detailed, and more specific base of information than aware to the cognitive functions of an individual is highly conceivable. To the area of decision-making, this type of research holds a fascinating key to unlocking the door of "gut-level" or "sixth sense" rationality.

Summary. The preceding discussion has reviewed the literature on decision-making methods. There appears to be a wide variety of concepts and an indefinite opinion as to which approach explains what decisions. One of the noted experts on theoretical modeling is Thomas Dye. Indicating that the purpose of a model is to explain, clarify, or simplify the understanding of a governmental, political, or administrative process, he suggests that models and methods are not competitive.¹³⁴ Therefore, no one idea can be judged "best." Each one provides a separate focus on the decision-making process.

It is the purpose of this study to design a new method for decision-making as applied to police patrol allocation. The theoretical importance here is that the method to be presented will integrate the four identified focal points of decision-making:

1. decision-making is a process (Souryal, Dror, and Wildavsky)
2. decision-making involves the ability to make rational choices (Simon, Iannone, and Sharkansky)

3. decision-making assumes a systematic methodology (Quade, Wilden, Nillsson, Dunn, Michael, and Schon)
4. decision-making is conducted by human beings attempting to achieve desired goals (Gore, Sperry, and Gazzaniga)

For this reason, the review of literature has been confined to a general overview, segmented into a categorization which provides an easy and uncomplicated manner in which to study decision-making models. In the next chapter, the fundamental design and theoretical framework of this new decision-making technique will be explained. This innovative method marks the major advancement proposed in this treatise.

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CHAPTER II

THEORETICAL FRAMEWORK: INTEGRATED MANAGEMENT DECISION-MAKING

The great advances made since World War II in both the theory and practice of organizational behavior have done much to raise the quality of managerial decision-making. Unfortunately, most of it has not yet been recognized by many police managers.

In the preceding chapter, four distinct yet related theoretical advances were identified decision-making is: (1) a process, (2) a rational ability, (3) a systematic methodology, and; (4) a human endeavor. The one key element to which each of the different authors prescribed is that decision-making is dynamic. It is continually changing, and what may be current today will soon be outdated. Nowhere is this phenomena more clearly stated than in the writings of Alvin Toffler--Future Shock and The Eco-Spasm Report.¹ Each of these works strongly indicate that traditional organizational structures and managerial decision-making practices are crumbling under the impact of accelerating changes in technology, social values and norms, and the amount of knowledge available.² These, and many other writings, clearly warn students of management techniques to concentrate on advanced concepts that attempt to avoid future problems. Just emerging as an academic discipline is the study known as "futuristics." Its aim is to develop specific planning, forecasting, and control techniques in order to cope with future contingencies.

Here then, is a major emphasis of an integrated approach to decision-making: to be able to survive and adapt to rapid change, to be flexible and prescriptive. In order to fulfill such a mission, a necessary quality for success must be in the integrative measures taken between organization and environment and between theorist and practitioner.

Further, the four theoretical perspectives that have been reviewed are in no way contradictory one to another; rather they are mutually compatible, with considerable overlap between them. Each theory stresses certain aspects of decision-making and neglects others. Logically then, an integration of these four considerations should present a relatively complete and innovative approach.

A Decision-Making Model

The decision-making process does not emerge immediately and clearly like a new rose budding in May, but gradually and steadily in a growing manner. Similar to Lindblom's "serial" concept of policy-making, decision-making occurs in a somewhat sequential form.³ However, instead of viewing decision-making as a progressive "mudding through" concept, it should be analyzed in terms of a specific response-action behavior. That is not to say that there are neatly detailed, refined and specific steps which are followed in coming to choice, but rather, that there are indeed a series of nebulous stages which form a behavioral framework to decision-making. These stages can be identified and discussed in terms of a response-action behavior.

Herbert Simon's concept of decision-making built on a principle of "phases," or Craig Lundberg's thoughts on decision-making

"classes," or William Gore's projections of "strategic parts," or Edmund Quade's uses of "structural techniques," were all attempts to classify these general "stages" in the decision-making process.⁴

All are analogous to a set of rather undefined and loosely connected behaviors within the decision-making process. These are: (1) problem recognition or awareness, (2) analyzing or doing something with information, and (3) formulating a choice.

Figure 1 provides a schematic view of decision-making as proposed by this dissertation. It should be emphasized that each stage does not represent a stringently defined and quickly visible step. Instead, the decision-making process is viewed as a series of response-action stages where clear lines of demarcation are not known nor are they relevant to the overall process. The important features are the integrated capabilities diagrammed between the environment and the organization.

One of the fundamental problems exhibited in other attempts to describe the decision-making process is in exactness. This is especially true in many of the systems approaches. There appears to be a set of rigid and firm boxes into which and out of which come exact issues and answers. Integrated Management Decision-Making (IMDM) is a direct attempt to alleviate this persistence. Decision-making cannot be viewed as a highly definable process with quantifiable inputs and calculable outputs. Instead, it is a very ambiguous and vague concept of an organizational behavior. Any attempt to measure or quantify the variables associated within this problem-solving process is extremely difficult, if not impossible.⁵ Additionally, one of the essential features for futuristic-oriented

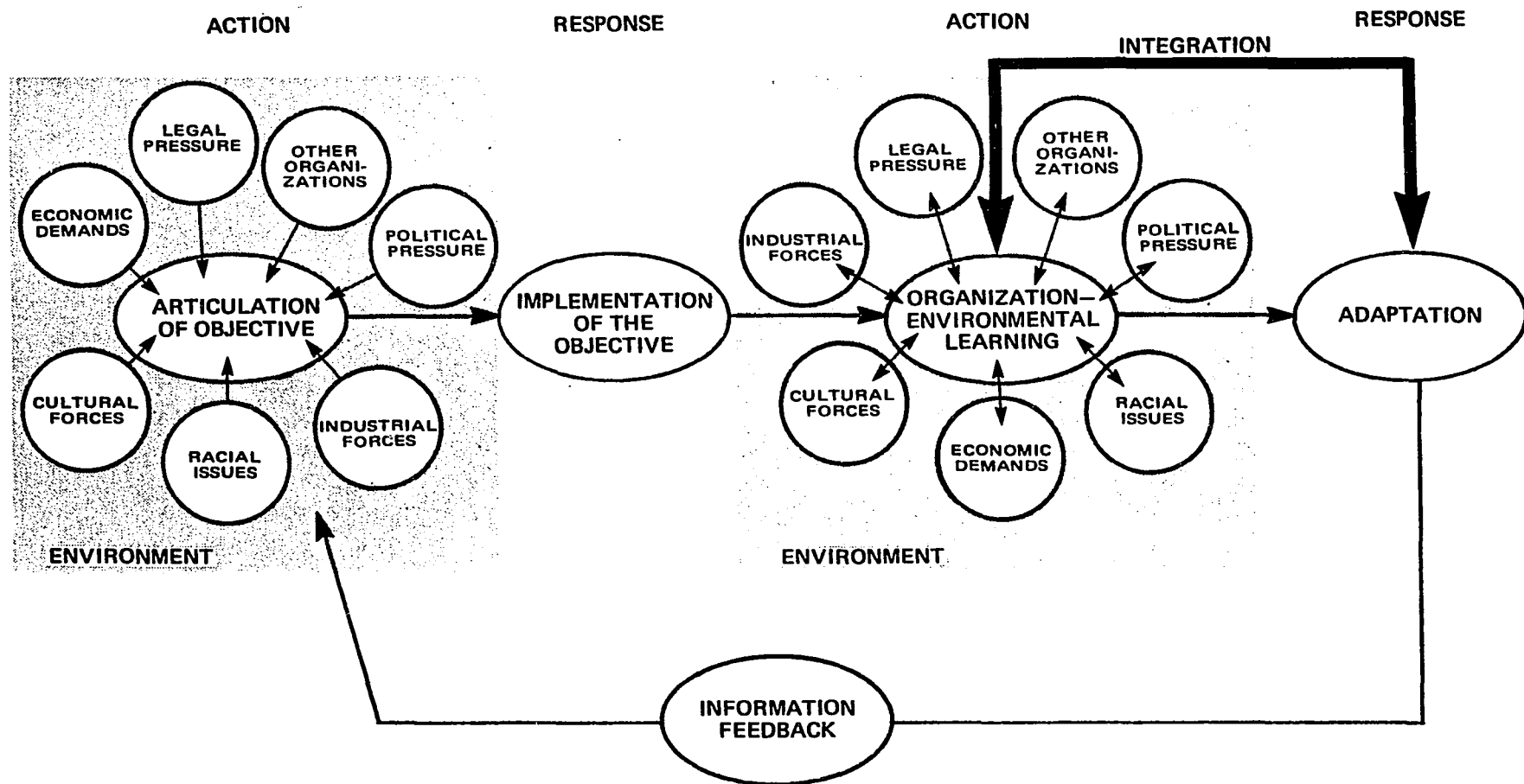


FIGURE 1: INTEGRATED MANAGEMENT DECISIONMAKING: A THEORETICAL FRAMEWORK

approaches in decision-making is flexibility. The model must be able to mold and conform to different contingencies and exogenous factors influencing the outcome. For example, any decision conducted by a public organization or administrator must be responsive and cognizant of political pressures. In short, most decisions involve a great deal of negotiation and persuasion rather than pure rationality.

Each of the "stages" comprising IMDM can be related to a response-action activity. This activity must center on information flow between stages, and between the environment and the organization. Communication and continual feedback is the backbone of IMDM.

This model represents a new method for simultaneously increasing communication, understanding, development of options, and a course of action between the organization and the environment. It is a dual-involvement perspective characterized by cognitive processes within the organization. It necessarily requires the ability to assess information, to plan ahead, to learn, and to adapt. These features are in contrast to the analytical and instrumental quantification approaches proposed in the past.⁶

Integrated Management Decision-Making can be characterized by the following practices: (1) It views the organization both as a system with its own subsystems and as a subsystem of a larger environmental system; (2) it takes a holistic approach, using techniques that emphasize the interrelationships among component stages; (3) it stresses flexibility and changing organizational structures; and (4) it attempts to strengthen the human aspect or input within the process. The following discussion attempts to focus on each stage of the model, highlighting the characteristics and advantages of the overall technique.

Articulation of the Problem. The concept of accurate and precise problem identification has plagued decision-making theorists for some-time. Recognized as the "beginning phase" for the decision-making process by Herbert Simon back in 1960, this critical and initiatory stage involves much more than simple "awareness."⁷ Donald Schon's Displacement of Concepts emphasizes this step as a behavior.⁸

Pointing out that people can only describe a problem in the language and terms that are understandable in their own respective world, Schon characterizes the identification of a problem as a shift in conceptual thinking.⁹ Linking the problem to "what was once working" and to what is now the "beginning" instead of the "old," a problem recognition involves a specific organizational action to an internal or external pressure.¹⁰ Thus, an organization exists in a state of suspended animation until some force comes to bear, initiating an action from the organization to define a problem in its own language and within its own contextual framework. Of course, the inherent fault lies in the perception of a problem. What an external or internal force conceives to be a problem may indeed be quite different from what the organization articulates to be the problem. The major crux of what is supposed to be a problem is lost when interpreted from the organizational reference. Thus, problem misconception can be construed as a difference in interpretation based on individual references both internal and external to the organization. These misconceptions make problem identification and articulation less valid and many times spurious in content.

C. West Churchman elaborates further on this issue. Indicating that we all make an incorrect beginning in viewing problems by

describing them "in terms of structure," Churchman advocates a complete change in thinking.¹¹ Instead of conceptualizing by means of description and structure, we should consider function and purpose. Perhaps the greatest strengthening for decision-making can come in this area. If we think in terms of structure, we naturally limit ourselves to the capabilities and capacities of our own point of reference; we cannot transgress the boundaries of our own, single environment, if we only think description. What is needed is to emphasize "central objectives;" to plan ahead in terms of specific accomplishments.¹² This attention to objectives and strategies would help: (1) to keep decision-making consistently focused rather than going off in many directions, which often produces failure; (2) to ensure that the specific decision techniques are harnessed to serving a meaningful purpose that are well thought out; (3) to plan for future contingencies, problems, and failures; and (4) to reduce problem misconception by clearly articulating objectives that are operationally clear and universally understood.

Thus, a shift can be seen as a change from describing a problem to stating an objective. It makes no difference what the problem is, if we agree on a course of action in response to the demand. For example, there exists an economic and political pressure on police organization to effectively and efficiently deploy patrol personnel within a limited budget. It is irrelevant if different interest groups define this as a problem in wasting governmental time and money, or a threat to crime control, or a burden to specific city locations. The important point lies in defining an objective to meet this need; such as allocation through equalized workload.

Implementation. Once such an objective is discovered, the second stage of the decision-making process is entered, that of implementation. It is critical that the issue of definition be highlighted in this process. That is, what exact intentions and events are to be accomplished. Pressman and Wildavsky have noted that the act of implementation is a process within itself, and that the environmental arena of implementation may be so intense that goals and objectives become vague, ambiguous, or lost.¹³ In other words, implementation, often times, accelerates the loss of definition.

Further, implementation is indeed a process. It can be viewed as a complex staging of events within the overall decision-making arena. Implementation focuses on the application of an objective to the environment. This may require the political or economic or cultural maneuvering of numerous and diverse elements, actors, and forces to accomplish an end result. The important aspect to consider is that implementation both expresses conflict and creates it; and that within every movement aimed at reducing a problem, there is an associated risk of actually making matters worse. Therefore, implementation does not just apply an objective, it produces change. And as Pressman and Wildavsky have so eloquently indicated, each step of the implementation process may "geometrically grow" as other issues or problems or crisis are caused.¹⁴ For this reason, organizations must adopt a decision-making model that is flexible and able to withstand buffeting by a constantly shifting set of environmental factors. Implementation involves the ability of an organization to apply an objective to the environment. This requires not only flexibility, but also futuristic insight; like planning and visualizing future situations, making

estimates of what will happen at each step of the process, identifying the issues and potential danger points, analyzing the different ways and means for reaching desired goals through the least resistive path; and initiating action in time to prepare what may be needed to cope with changing conditions and contingent events.

The recent literature concerning implementation indicates that many of these same concepts have been identified regarding change and complexity within the process. Jan Huyman writes that the extreme confusion regarding the meaning of the term implementation necessitates a "provisional working definition."¹⁵ Douglas Bunker suggests that the key to understanding implementation is to "identify the significant interaction points and actors" of the process.¹⁶ Donald Van Meter and Carl Van Horn stress further that the critical importance within the implementation process is in "calculating the amount of change" that will occur.¹⁷ And finally, Eugene Bardack simulates the process of implementation to a type of "gamesmanship" in which the organization attempts to maneuver elements necessary for accomplishing goals and objectives while still surviving in a turbulent and uncertain environment.¹⁸

To this point, implementation has been discussed as causing change in the environment. However, it also causes change within the organization. Essentially, implementation is a response to an action. The purpose of the process is to apply an objective to the environment after a specific action (problem) has been defined. What needs to be emphasized is that change must concurrently happen in the organization to successfully accomplish or carry-out its own decision. Thus, implementation causes change in both the environment and the organization.

Organizational-Environmental Learning. The third transitional stage in Integrated Management Decision-Making involves another process within itself; that of learning. To this point, the environment has not been fully defined from an organizational perspective. It can be considered the "independent cluster of persons, groups, organizations, political parties, and so forth, to which the organization must respond."¹⁹ The tenuous relationship between organization and environment is circular and active. In a sense, this relationship is characterized by an organizational action which is absorbed by the environment in the assumption that a beneficial change will occur.²⁰ For all practical purposes this exchange of information and activity can be described as organization-environmental learning.

Traditionally, this exchange of information has been assumed to be fragmental and sequential. However, the recognition of a systems design involving continual exchange of information between the two entities of organization and environment explore two main themes: (1) learning is a central subject for planning and decision-making, making the process "non-linear" (i.e. acting upon structures rather than variables of systems) and simultaneous in its general approach; and (2) learning is non-deterministic, future-creative, and places emphasis on adaptation and invention through forecasting.²¹

The concept of organization-environmental learning as a continuous and dynamic exchange of information is not new. There is considerable overlap here, with the recent writings of social planners such as Friedmann, Jantsch, Friend and Jossop, Kahn, Schon, and Michael.²² Friedmann expresses this concept best in his essay on comprehensive urban planning; "mutual learning involves a symbiosis

(between organization and environment) . . . that should go beyond a single interaction and extend to a continual relationship . . . that explores alternative futures for decision-making.²³

However, this perspective describes the ideal in organization-environmental learning. All too often, a variety of barriers exist which impede this process from being effective or continuous. A discussion of these restraints and blockades is essential in the study of organization-environmental learning.

First, according to Michael, the assumption of a passively responding environment versus an active and dynamic environment led to the belief that human relations were "naturally" of a hierarchial order.²⁴ Sociological studies by Weber, Mills, and Marx supported this hypothesis.²⁵ Further, this perspective has been abetted by our language structure, which implicitly assign, cause and effect, subject and predicate, and thereby implicitly treats social systems as if they were "naturally" linear rather than circular in process.²⁶

However, if we explore the writings of Warren Bennis and Chris Argyris, a much different perspective is argued.²⁷ Social systems are circular. The future, according to Bennis, will be characterized by a distribution of power and authority, a separation of management from ownership, and an "integration" of organizational goals with environmental demands and individual needs.²⁸ Argyris echoes these same observations in his work as he suggests that "any organization that is structured in a pyramidal form" will create a social system that is indeed impersonal and linear. However, he strongly advocates that "interpersonal incompetence" is sustained by these structures of

linearity within an organization that is characterized by stagnation.²⁹ Bennis and Argyris research into the interpersonal-personal behavior of organizational life emphasizes that social systems are not "naturally" linear but circular, that vertical-horizontal structures are functions of bureaucratic strategy, and that human effectiveness increases as involvement and dynamic interpersonal growth increases between individuals.³⁰ The point is that organizations, all too often, prohibit learning because of their "non-human-oriented" structure, which facilitates the concept of linear versus circular relationships.³¹

Another barrier to organization-environmental learning stems from this same structural problem, and involves information flow or communication. Since the processing and analyzing of information is a necessary prerequisite to learning, it seems only natural that the processes by which information is transmitted and received be conceptually clear and distinct. However, most organizations fail to either send or receive such transmissions. The problem can be seen as one of perception, confused by structure. This treatise previously discussed the inherent problems of misconceptions in communication because of reference groups or reference points. However, consider the complications of preconceived reputations or hidden agendas or lack of trust between sender and receiver. These foregoing factors influence the arena of communication because of structure.³² Hierarchical relationships within organizations dictate specific, preconceived assumptions; such as information and "orders" flow from top to bottom or from superior to subordinate. Communication involves effective receiving as well as sending. Consider an outside interest group

attempting to receive information from a bureaucratic establishment. What factors effect communication? Surely, attention must be paid to the "climate" or the "timing" of the communique to be effective.³²

Organization-environmental learning is predisposed to effective communication. If communication is considered directional rather than interactive, then learning is severely restrained. Both the organization and the environment must interact to effectively address the issues of change and implementation.

Identifying the involvement of interdisciplinary approaches in social learning, Magorah Maruyama focuses on another issue in communication.³³ He states that there exists three paradigms among planners: one-way causal (hierarchists), random-process (individualists), and mutual causal (mutualists). These paradigms stem from basic philosophical, epistemological, and scientific roots of various origins which form the basis of individual perceptions, behavior, and views. Analyzing these paradigms from an organization-environmental learning perspective, it is easy to understand that these different paradigms perceive one another to be illogical, unintelligent and even deceptive. Maruyama concludes that communication between the paradigms is severely limited, if not impossible.³⁴ Once again, what appears to be differences in references complicates the flow of information and hence, retards organization-environmental learning.

Another of the natural barriers to change is resistance. Robert Chin has elaborated on this theme in his analysis of the systems model. Reporting that most organizations wish to view themselves as stable, existing within a uniform and consistent environment, Chin advances his concept of "stationary equilibrium."³⁵ He proposes

that systems in equilibrium react to external or internal impingements, disturbances, or changes by refusing to acknowledge their existence. Remembering Wilden's classification of homeostatis, Chin believes that resistance can be further advanced by simply "bringing into operation those forces that restore or re-create a balance."³⁶ Donald Schon's idea of "dynamic conservatism" is analogous to this concept.³⁷ Describing a world where organizations refuse to change or adapt to the dynamic environment, Schon proposes that "systems learn to become capable of transforming themselves."³⁸ If they do not, then a crisis of disruption or continual conflict occurs between organization and environment in which institutions, business firms, public establishments, and private enterprises lose personal identity, legitimacy, and confidence. The natural result is chaos "beyond the stable state."³⁹

Thus, inherent to the decision-making process, is a stage of learning whereby information must freely flow between and within organization and environment. This communication of ideas and information must transcend those barriers described and essentially integrate organizational and environmental change.

Adaptation. The crucial element of Integrated Management Decision-making is indeed integration. It occurs between the stages of learning and adaptation, where change is most pronounced and most identifiable. Integration at this point, would accentuate the requirements for effective matching of the organization to its environment through internal restructuring. This is mutual adaptation. In support of this concept, Michael writes:

Of the utmost importance, with more informational exposure (from the organization) to the environment, the environment would be perceived as itself differentiated and integrated into a variety of patterns according to the appreciative settings in the organization and among members and groups in the environment that influence the organization.⁴⁰

In other words, integration is an ideal process within decision-making whereby the adaptive and learning stages between organization and environment become one. It still remains theoretically important to delineate these two stages in order to describe a singular restructuring of either the organization or the environment; independent of one another. What Schon describes as the loss of the stable state is this singular change. IMDM proposes to facilitate mutual aggregation through clarifying and displaying the decision-making process as a behavior, and a product of the organization-environmental system. In this manner, the model proposes that organizational structures are decision-making strategies designed to achieve specific objectives. Argyris' comments are extremely supportive at this time:

The structure of the organization is a snapshot or static picture of the dynamics of the strategy being used. From our point of view, (a decision-making) strategy that optimizes the organizational core activities of achieving the objective, maintaining the organization, and adapting to the environment is the best strategy.⁴¹

Therefore, decision-making is essentially restructuring the organization to fit the environment and vice-versa. The processes of adaptation and learning are those stages which allow each entity to cope with change in an orderly, methodical, and controlled way. In this manner, Integrated Management Decision-Making can be viewed as an educational strategy in response to change. Taking on an organizational development feature, IMDM facilitates a "change in beliefs,

attitudes, values, and structures of organizations so that they can better adapt to new technologies, markets, challenges, and the dizzying rate of change itself."⁴²

Information Feedback. The final stage in the decision-making process is information feedback. It is through this crucial looping of information that a system evaluates where it is in terms of where it intends to go. It is the means by which evaluation takes place, where error is detected and "thereby it provides the basis from learning how to get from here to there through changes in performance that result in successive reductions in error."⁴³ Of central importance for decision-making, feedback also provides the information needed to assess the current state of organization-environmental balance. In this manner, feedback provides the mechanisms, for revising definitions of the present, along with the means for linking them with future actions.

Effective information feedback focuses on matching the organizational actions and goals to the environmental conditions. In this context, feedback must constantly emphasize the detection of environmental signals that reflect organizational action. If such signals are not generated or perceived, then the process ceases to be a system. Therefore, feedback provides the network of monitoring environmental change.

This task is extremely important for decision-making, however, it is complicated by several factors. First, there are the continual communication problems (previously discussed) which formulate ambiguities in goals and objectives. These make it difficult, if not impossible to specify what signals can act as relevant feedback.

There are also contradictions and ambiguities within the organization itself as to which objectives are important and which are not; again, making interpretation of feedback difficult. Second, the relationship between environment and organization is dynamic and turbulent. In this unstable state, a natural barrier exists which may prohibit responses between organization output and environmental impact. Emery and Trist wrote extensively on this subject matter--the blockage of feedback loops caused by environmental upheaval.⁴⁴ Then too, the environment in which organizations interact is extremely complex and large. This facilitates inadequate and confused technological and conceptual schemes for evaluation. Finally, there are time constraints and resource limitations, along with other organizational characteristics that permit no more than a "bounded" viewpoint or reference to "rationality."⁴⁵ Obviously, that was what Simon contended in his theoretical argument.

Integrated Management Decision-Making attempts to alleviate many of these information feedback barriers through restructuring. Since the focal point and main emphasis of IMDM is on integrated learning between organization and environment, a forced restructuring of information monitoring components must occur. Many of the ambiguities and confusions existing in organizations are due to a failure to openly interact. Distrust, anxieties, and status produce a fear of feedback; since more information will be available to more sources about the environmental consequences of one's activities. IMDM stresses learning; and if that can occur only through trial and error or mistakes, then so be it. Restructuring of the organization to totally respond to the environment through integrated means is essential.

This is not a new concept, it is just an underdeveloped one. The emergence of futuristic thinking stresses strategic planning, economic forecasting and analysis, and creative modeling to grasp the multi-dimensional levels of organization-environmental feedback.⁴⁶

Once again, Michael concurs with this concept:

Ideally, feedback should help reduce uncertainty by clarifying the extent to which intended result is presently on track and the ways in which it is not; and by clarifying and discriminating between options by feeding back into the present, so to speak, carefully worked out conjectures about the future . . . (this necessitates) changing to structures that facilitate this process.

Here then, is the basis of Integrated Management Decision-Making; to be innovative and imaginative in forethought based on an interactive learning and feedback experience between organization and environment. This process enables both entities to alter and adapt in original design through trial and error or evaluation. Such a process is flexible, and is characterized by fluidity and continuous evolvement between stages.

Integrated Management Decision-Making and Police Patrol Allocation

The allocation of patrol personnel is one of the most important decisions a police manager can make since between 70-95 percent of most police budgets are for salaries, it is apparent that the major cost for resources involves a department's manpower.⁴⁸ Therefore, the obvious starting point for increasing productivity and managerial decision-making must focus on the effective and efficient utilization of police manpower. Further, patrol deployment not only produces a significant economic factor for police agencies, but also creates a

number of other social, political, and community ramifications. For instance, the way in which police are allocated has far reaching racial tones in many cities as well as political gestures for ruling elitists; or allocation design may drastically effect certain crime patterns (i.e. prostitution, pornography, drug abuse) which in turn, may bolster social reform and social change movements. Therefore, it is essential that police manpower allocation be conducted through a process which provides for futuristic thinking and concurrent organization-environmental learning.

Additionally, manpower allocation is characterized by a multiplicity of decisions. It is not determined by a single judgment or sole quantitative figure such as the increasing or decreasing of police personnel. Rather, patrol allocation is derived through the calculation of several independent decision-products. These are:

- (1) The computation of an assignment availability factor,
- (2) The determination of shift and manpower requirements,
- (3) The design of sectors or beats, and;
- (4) The selection of a patrol strategy.

These decisions must be integrated with one another as the organization adapts to the environment with which it is changing.

Another important consideration concerning the focus of this study, is found in the conditions surrounding deployment designs for small urban cities. As elaborated in Chapter I, there appears to be several factors (i.e. increased crime patterns, economic instability, social and political uniqueness, and non-comprehensive, traditional deployment plans) which exacerbate the failures of allocation decision-making in this critical police area.

For these reasons, there is a need to improve decision-making in the deployment of police personnel. Integrated Management Decision-Making provides the means by which advancement to effective and efficient manpower allocation can be achieved. This process incorporates three specific features which overcome several of the deficiencies previously described in other manpower deployment methods. These are:

1. IMDM does not need the direct use of a computer and certainly not the continual use of a computer assisted dispatch model. This feature alone decreases cost and complexity.
2. IMDM provides a way to continually update and modify patrol deployment plans without costly additions or technological applications. This is accomplished through quarterly evaluations of specific variables utilized in the deployment plan, and;
3. IMDM address the local, decision-making elements of small urban centers by incorporating direct input from police manager and other community officials. This feature provides a means for assessing and evaluating various environmental concerns such as political pressures, economic demands, racial issues, cultural forces, etc. which have an important impact on managerial police decision-making and manpower deployment.

NOTES

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CHAPTER III

RESEARCH METHODOLOGY

In the previous chapters, the general nature of decision-making as applied to police organization and management was discussed; and those prior efforts to examine mathematical designs in patrol allocation was reviewed, noting both their contributions and shortcomings. Additionally, in this chapter, a new technique entitled Integrated Management Decision-making was introduced to provide a new and innovative model for decision-making. Here, specific parameters for the application of this model (to police patrol allocation) are delineated dealing with the research design, the nature of the data, the statement of research objectives, statistical analysis and hypothesis, and the definition of specific terms. Each of the above necessarily places restrictions on the course of this study and, therefore, will be addressed in some detail.

Research Design

This study was undertaken to examine and review the theoretical issues concerning decision-making. From this search, a new model was formulated Integrated Management Decision-Making. This model was applied to the task of police patrol allocation in small urban centers. The City of Jonesboro, Arkansas, was used as a test case for the demonstration of this process.

Matilda White-Riley points out that the test-case study design is highly effective when conducting exploratory research for model building.¹ The procedure provides for an extremely detailed, descriptive, qualitative and quantitative approach to the understanding of a social system or decision-making process.

Further, if we consider the inheritance of a test-case approach from the social sciences, we find a methodology that enables the researcher to explain more clearly what has happened in particular circumstances, and to illuminate the social, cultural, and managerial dynamics governing ways in which people respond to new events and new procedures.

Although our horizons are strongly influenced by quantitative studies and statistical analysis, there remains a conventional test case approach to management decision-making and policy formation that is derived from these social science methodologies. Pressman and Wildavsky's insight on implementation in Oakland is a case in point.² As Geis and Stotland noted recently, test-case studies and demonstrative analysis can make a contribution to systematic scholarly research on decision-making, and they have been pleased to find that the tradition is enjoying a rebirth.³ Further, this research design is not only descriptive in nature, but can be used to systematically measure the response of the environment, given an external stimulus. Specifically, this approach is most suited to test new ideas and innovations in organization-environmental behavior.⁴

Data Source

To a large extent, there is a lack of adequate research with respect to decision-making and police manpower allocation. This may

be attributed to the inadequacy of available data sources. Police agencies, often fail to record and report statistics in a form amenable to social research. Criminal activity data and number of calls for services, for example, are often incomplete and not compiled in a manner which easily links possible predictive variables to manpower allocation. It is not surprising that earlier investigations of manpower allocation have centered attention solely on mathematical designs not considering management objectives, goals or decision-making processes, since such data is often subjective and difficult to assess. Rarely, specific projects are undertaken which attempt to weave the raw data and the subjective values together in an attempt to formulate an ideal method.

The raw data base for the present study was derived from radio-dispatch logs, detective entries, and official criminal incident reports maintained by the Jonesboro Police Department. Every radio call dispatched to a uniform or detective unit in the Jonesboro Police Department was explored for the time period of January 1, 1980 to December 31, 1980. During this one year period, data were compiled on over 8,300 police requests. A complete census of this time period was taken based on three issues:

1. A census of a complete year compensates for seasonal variances.
2. One year, is in actuality, a sample in itself. According to Shanahan, the use of the preceding year gives the most accurate data base for manpower distribution needs.⁵
3. The Jonesboro Police Department Records Division and Radio Division are currently undergoing a radical change in main-

tenance of criminal activity statistics, police reports, and radio dispatching procedures. The collection of accurate and complete data previous to 1980 would be impossible.

Thus, the challenge facing the Jonesboro Police Department, and other agencies, is to obtain maximum efficiency and effectiveness in deploying police manpower resources based, in part, on collected historical data. There are inherent limitations to this data source. First, not all requests for police services, especially those involving "cold" felony-type crimes (i.e. week-old burglaries, aggravated assaults involving known offenders, and miscellaneous sex offenses) are tabulated in police dispatch logs or officer reports. Instead, such cases are often handled strictly by Detective Division, bypassing direct police service. This practice has been somewhat confined by the implementation of a "911" emergency number, yet an estimated ten percent of criminal activity is reported to police via this method.⁶

Additionally, statistical data derived from police reports are often misconstrued as "crime rates." Crimes known to the police bear an unknown relationship to actual total criminal activity. Obviously, many crimes are never reported to the police.⁷ Wilson and Boland argue that since police have little or no control over the willingness of citizens to report crime, then the only measures viable for study are those which at least display calculable sums for a reference in patterns and trends.⁸ For this reason, calls for services are suggested as measurable indicators for workload among police.

Aside from the raw data, subjective values and priorities are placed on each variable tabulated from the 8,300 requests for police

services (by the police manager). In this manner, police allocation is developed to accommodate the individuality of the community for which it is designed.

Predictability and the Nature of the Data

While there are several approaches to the manpower distribution problem, all have the common denominator of attempting to predict or forecast needs for police services. Traditionally, and in this study, a sample of past events has been recorded under the assumption that history will repeat itself. It has been assumed that previous calls for service will continue to occur in the same frequency and in the same geographical location. It is important to note that there is an irreducible limit to the precision which can be obtained from any predictive mechanism. To some extent, those things which are to be predicted are intrinsically uncertain. No matter what kind or how much data are collected, or how these data are processed, completely accurate forecasts are unobtainable.⁹ The practical problem is to obtain as much accuracy as possible.

The problem of accuracy has several aspects. In general, there is no scientific theory which purports to explain the genesis of calls for police services. To some extent the process which generates these events is under control of the police department. By adopting an internal policy, the rate of calls can either be increased or decreased within limits. At the same time much of the generation of calls for services can be explained only by factors which are completely outside the control of the police department. Moreover, these exogeneous factors are dynamic; they are in a continual process of

change and must somehow be allowed for in the predictive mechanism. Thus, a predictive procedure which attempts to explain or predict the generation of calls for service in terms of a structural model involving a fundamental set of exogeneous, independent variables, must at the same time predict the police department's own internal policies. In the present state of knowledge it is unlikely that a sufficiently flexible predictive model can be constructed on this basis.

The principal alternative to a structural model is some type of reduced form which predicts future events in terms of the past history of events, as produced in this dissertation.

Definition of Terms

The most frequently used terms are defined in the context in which they are used in this study.

Police Unit. A police patrol call occupied by either one or two officers assigned to a specific geographical area.

Police Call. A request for police service that was transmitted from the radio dispatcher to the police unit.

Back-up or Cover Unit. A second police unit dispatched to a location.

Sector. A specific geographic area assigned to a patrol unit; a beat.

Shift. An arrangement of working hours which allows x-number of police units be available on a twenty-four hour basis; duty period.

Response Time. The period of time calculated from dispatch time to arrival time.

Call Time. The period of time calculated from arrival time to clear time.

Elapsed Time. The period of time calculated from dispatch time to clear time.

Police Patrol Techniques. A variety of police patrol programs aimed at controlling the level of occurrence of specific crimes in designated geographical areas. Examples of these techniques are Crime Specific Analysis, Directed Patrol, Two-man Patrol, and Team Policing.¹⁰

Operationalization of Variables

The following variables are selected to be included in the present study.

Time. The variable of time was measured in six different modes. Each police call was tabulated by: (1) month of the year, (2) day of the month, (3) day of the week, (4) dispatch time of the police call to the police unit, (5) arrival time of the police unit to the dispatched location, and (6) clear time or time which the police unit left a dispatched police call and was available for additional duties.

Weight Factor of Call. This is a subjective assignment, of ordinal nature, based on the urgency of the police call. The weight coincides with the response procedure conducted by the dispatched police unit. Weight factor 3 is a "code 3" call representing a criminal act in progress or an emergency displaying imminent peril to human life (i.e. a robbery in progress, an officer needs immediate help, or a shooting); weight factor 2 is a "code 2" call representing a need for assistance rapidly, however, no imminent peril to human

life exists (i.e. a family fight, a neighborhood disturbance, a burglary alarm); weight factor 1 is a "code 1" call representing a need for assistance without urgency (i.e. a "cold" burglary, an escort request, a barking dog). Traffic accidents were weighted based on the in-depth analysis of police reports which reflected an emergency condition, the nature of injuries sustained, if any, and/or the existence of an imminent threat to human life.¹¹

Allocation of a Second Police Unit. A simple two digit code classified the presence or absence of a dispatched back-up or cover unit.

Seriousness of Arrest. The variable of seriousness of arrest was separated into four ordinal classifications: (1) no arrest made stemming from the police call, (2) a traffic citation or police summons was issued, (3) a misdemeanor arrest was made stemming from the police call, or (4) a felony arrest was produced from the police call. All charges or arrests were classified by the Arkansas State Criminal Code as to felony or misdemeanor in nature.

Type of Incident. Each dispatched police call was nominally classified into the following types of incidents:

1. Murder - Homicide
2. Aggravated Assault
3. Forcible Rape
4. Robbery
5. Burglary
6. Theft over \$100.00
7. Auto - Motor Vehicle Theft
8. All other criminal offenses of a felony nature

9. All other criminal offenses of a misdemeanor nature
10. Traffic accident
11. Calls for service (miscellaneous)
12. Neighborhood problem/disturbance
13. Family fight/problem
14. Assist outside agency
15. Alarms

Subjective Prioritization. This critical element to the decision-making method was a simple ordinal ranking of raw data variables into most desirable to least desirable for allocation design. This prioritization of variables was a direct input from the police manager.

Geographical Location of an Incident. A map of the surrounding Jonesboro, Arkansas, area (approximately 150 square miles) was divided into 260 square geographical blocks, each block representing a .5 square mile location within the metropolitan center. Each block was alphabetically and numerically coded. Whenever a police call was tabulated, the specific geographical block code was used to designate location. There were 57 such blocks within the city boundaries.

Multiple Response Index (MRI). A calculated value for each of the above described geographical locations based on the subjective prioritization of variables by the police manager. Multiple response indices are determined through the SPSS program, Multiple Response Analysis. For this study, the multiple response index for a given geographical location is calculated by prioritizing the variables of (1) incident type, (2) weight factor, (3) seriousness of arrest, and

(4) allocation of second police unit. The summation of this prioritization for each police call tabulated within a specific geographical location equals the multiple response index.

Equalization of Workload. A calculation which represents the same proportional amount of work per officer independent of day, duty period, or geographical region. This variable is measured by calculating a value (the multiple response index) for a specific geographical region. The measurement of this variable assumes that each officer is equally capable of serving a call.¹²

Calls for Service. The number of police calls tabulated within a specific period of time.

Statistical Analysis

Measures of association and tests of significance are utilized to examine the relationship between variables in order to design an ideal decision-making method for police patrol allocation. Much of the earlier research on the topic of optimum patrol design (discussed in the previous chapter) has employed either one or the other of these techniques, but few have simultaneously used both. Measures of association are used to designate the strength of relationship between variables, while tests of significance give indication of the probability of whether relations observed are due to chance variation.¹³

In this study, there are two analytic procedures to be utilized, Multiple Response Analysis and the Kruskal-Wallis Analysis of Variance by Ranks.

Multiple Response Analysis (MRA). This particular statistic has been incorporated into the Statistical Package for the Social Sciences (SPSS), an integrated system of computer programs designed for the analysis of social science data.¹⁴ The system was developed at the National Opinion Research Center at the University of Chicago in 1970. Multiple Response Analysis is a non-parametric technique displaying the strength of a relationship between variables.

It is a statistical procedure which preserves the order of the responses or variables (input) and permits analysis of the "most important" variable as though it were a normal variable. This technique holds constant the prioritized ordering of input data. The design specifically permits analysis of simple variables, multiple dichotomies, and multiple response items both individually and in conjunction with one another. The procedure provides two types of output--frequency tables and n-way crosstabulations.¹⁵

The statistics provided by MRA which are used in this study are the following:

1. Chi-Square: Chi-square is a test of statistical significance which determines whether a systematic relationship exists between variables. This is done by computing the cell frequencies (of a table) which would be expected if no relationship is present between the variable given the existing row and column totals. The expected cell frequencies are then compared to the actual values found within the table.¹⁶
2. Contingency Coefficient: The contingency coefficient C is a measure of association based upon chi-square. It is used to compare tables having the same dimensions.¹⁷

3. Multiple Reponse Index (MRI): This is the most important computation from the Multiple Response Analysis technique. A separate value is calculated for each data entry based upon an additive and weighting process.¹⁸ The MRI is a value to be utilized in other statistical techniques (for this study, the Kruskal-Wallis Test is employed), to examine the relationship between subjective variable input (from the police manager) and equalization of workload.

Multiple Response Analysis is selected for the present study since it meets all the basic analysis needs for this dissertation. It utilizes measures of association between variables in nominal scale.

The Kruskal-Wallis Test. The Kruskal-Wallis Analysis of Variance by Ranks is an extremely useful test for deciding whether k-independent samples are from different populations or have extreme differences in mean parameters. Sample values almost invariably differ somewhat, and the question is whether the differences among the samples signify genuine population differences or whether they represent random chance variables such as are to be expected. The Kruskal-Wallis technique tests the null hypothesis that the k-samples come from the same population or from identical populations with respect to averages. The Kruskal-Willis Test can be used for comparative purposes.¹⁹

The test assumes that the variable under study has an underlying continuous distribution. It requires ordinal measurements of that variable.²⁰

Compared with the most powerful parametric statistic, the F-test, the Kruskal-Wallis Test has a power efficiency of 95.5 percent.²¹

The test involves a comparison of the sums of the rankings for each of the categories of the nominal-scale variable. In this study, original manpower design is nominally divided into sectors, the summation of rankings of Multiple Response Indices is then compared to the proposed manpower design. A statistic H is computed in order to measure the degree to which the various sums of ranks differ from what would be expected under the null hypothesis. The sampling distribution of H is approximately chi-square.²²

The Kruskal-Wallis Test is selected for the present study since it meets all the basic analysis needs for this dissertation. It was chosen rather than the equivalent parametric test in order to avoid making the assumptions concerning normality and homogeneity of variance associated with the parametric F-test, and to increase the generality of findings.²³

Statement of Hypothesis for the Kruskal-Wallis Test

It is assumed that the medians of the multiple response index populations are equal.

Limitations

Several important limitations of this study must be mentioned. Since each of these may have implications for the results, they should be given attention as limiting factors.

First, the data for this study are limited by time and space. The population is limited to calls for service for the Jonesboro, Arkansas Police Department. Only police calls which were actually dispatched to police units were given consideration. Further, the data are derived from incidents occurring only in the year 1980.

Missing or incomplete sampling is an unavoidable limitation of this study. Data were compiled from police records which do not have exacting controls or accuracy checks. It is probable that certain insignificant calls (such as barking dogs, misparked cars, etc.) were not represented on the radio-dispatched log for each occasion. Then too, the sample size of over 8,300 pieces presented human observation and tabulation procedures which may have resulted in error. These measurement errors weaken statistical relationships which means that they may truly exist even though they are shown to be statistically insignificant.²⁴

In the techniques of analysis selected, the chief limitation is that the Kruskal-Wallis Test is insensitive to population normality and homogeneity of variance. The data presented in this study is nominal and ordinal and, therefore, discrete. However, the Kruskal-Wallis Test is the most appropriate and efficient test given the data assumptions. It converts scores to ranks, thereby preserving magnitude of the scores and utilizing more of the information in data observations than any other non-parametric statistic.²⁵

Finally, this study is restricted to a unique case--Jonesboro, Arkansas. Also, the study is restricted to the variables in the data base. Even though the major objective of this dissertation is to design a method for decision-making in which different variables from other city departments may be utilized, it must be emphasized that the results of this study would probably be different if the information was taken from other points in time and location.

NOTES

¹ Matilda White-Riley, Sociological Research (New York: Harcourt, Brace, World Publishers, 1963), p. 72.

² Jeffrey Pressman and Aaron Wildavsky, Implementation (Berkeley: University of California Press, 1973), p. 7.

³ Gilbert Geis and Ezra Stotland, editors, White-Collar Crime: Theory and Research (Sage, 1980), pp. 11-12. Their comments are directed specifically at four contributions in their volume: Laura Shill Shrager & James F. Short, Jr., "How Serious a Crime? Perceptions of Organizational and Common Crimes," pp. 14-31; Michael D. Maltz and Stephen M. Pollock, "Analyzing Suspected Collusion Among Bidders," pp. 174-198; Ezra Stotland, Michael Brintnall, Andre L'Heureux & Eva Ashmore, "Do Convictions Deter Home Repair Fraud?" pp. 252-265; and Mary V. McGuire & Herbert Edelhertz, "Consumer Abuse of Older Americans; Victimization and Remedial Action in Two Metropolitan Areas," pp. 266-292. Note that an earlier reader includes a number of examples of "test-case studies and historical analyses," drawn largely from the 1950's and 1960's; see Gilbert Geis and Robert F. Meier, editors, White-Collar Crime: Offenses in Business, Politics and the Professions (The Free Press, 1977).

⁴ Samuel A. Stouffer, Social Research to Test Ideas (New York: Free Press of Glencoe, 1967), pp. 253-260.

⁵ Donald T. Shanahan, Patrol Administration: Management by Objective (Boston: Allyn and Bacon Publishers, 1978), p. 372.

⁶ This figure is based on a randomly designed survey conducted at the Jonesboro Police Department in an effort to roughly estimate the amount of criminal activity reported to Detective Division and not tabulated in radio-dispatch logs or officer reports. By sampling five days within each of the twelve months of 1980, detective reports were compared to dispatch logs. Of the over 780 reports filed by detectives within the sampled 72 days, only 81 cases (10.4%) were not similarly logged in the police radio-dispatch log.

⁷ For a complete discussion regarding the inaccuracy of criminal statistics, see Nigel Walker, Crimes, Courts and Figures (London: Penguin Publishers, 1971), and National Criminal Justice Information and Statistics Service, Criminal Victimization in the United States (Washington, D.C.: Government Printing Office, 1976), p. 10.

⁸ James Q. Wilson and Barbara Boland, "The Effect of Police on Crime," Law and Society 12, (Spring 1978), p. 268-269.

⁹ Robert F. Crowther, Police Manpower Resource Allocation Systems (New York: System Science Organization, (November 1965), p. 2.

¹⁰ Police patrol techniques are an array of proposed programs concentrating on specific crimes in specific areas. For a full discussion of such techniques, see George J. Sullivan, Directed Patrol (Kansas City: Kansas City Police Department, Operations Research Division, 1965); Lawrence W. Sherman, Catherine H. Milton, and Thomas V. Kelly, Team Policing (Washington, D.C.: Police Foundation, 1973); Anthony M. Stratton and Sheldon I. Arenberg, Crime Specific Analysis (Sacramento, California: California Department of Justice Training Center, 1980).

- ¹¹ Shanahan, pp. 372-374.
- ¹² Shanahan, pp. 371-397.
- ¹³ Hubert M. Blalock, Jr., Social Statistics, second edition, (New York: McGraw-Hill Publishing Company, 1979), p. 285.
- ¹⁴ Norman H. Nie, et al, SPSS-Statistical Package for the Social Sciences (New York: McGraw-Hill Publishing Company, 1975).
- ¹⁵ Norman H. Nie, et al, SPSS-Batch Release 7.0 Update Manual, 1977, p. 3-15.
- ¹⁶ Nie, et al, p. 223.
- ¹⁷ Nie, et al, p. 225.
- ¹⁸ Nie, et al, pp. 97-100.
- ¹⁹ Sidney N. Siegel, Nonparametric Statistics for the Behavioral Sciences (New York: McGraw-Hill Publishing Company, 1956), p. 184.
- ²⁰ Siegel, P. 185.
- ²¹ Siegel, p. 193.
- ²² Siegel, p. 192.
- ²³ Siegel, p. 189.
- ²⁴ Blalock, p. 414.
- ²⁵ Siegel, pp. 193-194.

CHAPTER IV

APPLICATION OF INTEGRATED MANAGEMENT DECISION-MAKING MODEL TO POLICE PATROL DEPLOYMENT METHOD

In this chapter, a transition is presented from the theoretical model to the practical method of police patrol deployment. Similar components are discussed in relation to this transition. Further, a description of the Jonesboro, Arkansas Police Department, as well as the city itself, is provided for reference information.

The final part of this chapter focuses on the decision-products derived from the application of this model to patrol deployment in Jonesboro. As mentioned earlier, these decision-products include the determination of : (1) assignment-availability factor; (2) shift requirement; (3) sector design; and (4) patrol strategy.

Transition From Model to Method

In Chapter III, the theoretical framework for Integrated Management Decision-making was presented. Here, refinement of the model produces a method which can be employed in the allocation of police patrol in small urban centers. Each "stage" of the theoretical model can be correspondingly deduced to a step within the deployment method. Therefore, this transition assimilates conceptual components to working parts in order to accomplish a desired result.

Criteria. The initial step in any problem-solving model (whether it be conceptual or practical) is to define and set objectives. The

criteria step in the deployment plan is congruent with the "articulation of objective" stage in the theoretical abstraction, with additional elaboration.

The objective for manpower deployment is allocation based on equalized workload. However, there are interpretive problems as to what exactly is "equalized workload." As described in Chapter I, equalized workload studies have produced a variety of programs based on observations and activity reports that classify "equalized workload" in terms of hazard-formula, police time, total activity, preventative patrol, type of call, etc.¹ It should be clearly noted, that the purpose of equalizing workload is not necessarily to reduce crime, but to increase the productive use of existing resources. Thus, the unique feature built-in to the criteria step of this method involves the selection and prioritization of variables on which the objective is structured. The police manager or police chief selects a set of variables which act as "steps" to the accomplishment of the objective. In every city there are a number of external or internal variables which effect patrol deployment. Some of these may be the type of police call, the elapsed time of each call, the number of serious shootings per district, the number of drunk driver caused accidents in a given time period, the type of arrests made in a specific location, response time, number of assaulted officers in each district, number of reported crimes per location, etc. The list can go on forever; and is limited only by the user's imagination and the ability to collect relevant data pertaining to each variable. For example, a police chief could not select the variable of number of elderly white rape victims per district if he had no historical record

nor manner in which to collect the age or race of victims. The variable has to be tabulated, or at least, able to be documented for use in the allocation-deployment method.

Further, the criteria stage is designed to accommodate up to five selected variables. Each variable is prioritized as to most important to least important in the design of patrol sectors and the feasibility of patrol strategies. Each variable receives this prioritization by use of the multiple response index. A simple weighting scale is designed so that the number one prioritized variable receives the highest value and the least important variable receives the lowest value.

As demonstrated for use in this study, the police chief in Jonesboro, Arkansas selected the following variables, listed in order of importance (highest-first):

Type of call per district = weight of 4

Priority of call per district = weight of 3

Type of arrest made at each call = weight of 2

Need for assistance or cover at each call = weight of 1

The chief wished to select only four variables, however, he could have chosen one more, or conversely deleted two. In any case, the variables chosen were documented on dispatch logs and activity sheets rendering an historical pattern for the past year. The selection and prioritization of variables is an extremely important element in the method as all further analysis and processes assume the "criteria" as a fundamental guideline on which to base the achievement of the stated objective.

This step provides two innovative procedures in the design of a deployment plan. First, the "criteria" or variables on which the objective is structured can be altered to fit the management desires of any department. By simply "plugging-in" those variables by which the user wishes deployment to be predicted, the method takes on a flexible and adaptive quality unique to each community environment or departmental characteristic. For the first time in allocation design, the input for deployment is strategically placed with the police manager. All too often, the consultant or researcher entertains the illusion that he is the expert in the community under study, as Maruyama so accurately stresses.² This design method emphasizes the utility of management input. Further, the selection of criteria is not limited to that of the police chief. It is highly advisable that user input be broadened to include attitudes of non-police, city administrators. Since funding and expenditure are often times political entities, it should be natural for input to include those ideas from controlling bodies such as mayors, councilmen, aldermen, and other community leaders. Involving the power structure of any community into critical decision-making (such as "how" police manpower is distributed) maintains an optimum communication-feedback between the city government and the police organization as well as identifies any political or opposing phenomena.

Secondly, this patrol plan incorporates the use of several different variables in the allocation of manpower. It is not based on a singular or structured variable. It has the unique capability of changing with different departments, environments, and times as the future evolves. This enables any department to maintain a dynamic

feature in patrol deployment amid a turbulent and rapidly changing environment, so characteristically documented in today's world.³

Allocation. This step is similar to the "implementation" stage. It requires doing something with data and information. In this step the design of allocation is applied to the environment or; the decision-products regarding equalization by prioritized criteria are computed. The allocation of manpower is based on the equalization of workload represented in multiple response indices predicated by the selected criteria. Certain values such as assignment-availability factors, workload by month and day, workload by hour, response time, and frequency of police calls by month, day and hour are determined to establish shift requirements and sector design. Allocation can be viewed as a response of the police organization to environmental pressures existing in the "criteria" stage.

In this study, the Kruskal-Wallis Analysis of Variance Test is utilized to compare workload in the original sector design (currently used in Jonesboro) to the proposed sector design (which results from a physical manipulation of district/beat boundaries attempting to equalize workload). The calculated H value, approximately chi-square and having a power efficiency of 95.5 percent of that of the F test, indicates differences between sector workload within the two designs. The Kruskal-Wallis procedure will be further discussed later in this chapter.

Strategies. In this section, an assessment of patrol strategies and techniques is discussed in order to select a particular form of patrol. Herman Goldstein has raised an interesting point in his book, Policing a Free Society.⁴ Once sectors have been designed and a

number of men have been deployed to areas of police protection, the level of patrol is of less importance than the form of patrol activities. Stated much more simply, the Kansas City experiment showed no significant differences in the incidence of crime resulting from variations in the number of officers assigned, or level of patrol. However, the form of patrol has proven to make a significant difference when considering the evaluations of Team Policing, Directed Patrol, Split-Force Patrol, Tactical Patrol, etc.⁵

The "strategies" component allows the police manager to assess different patrol forms singularly or in combination with the "allocation" of sector designs presented in the earlier step. The ideal situation, facilitated by the method, is to match sector and shift design with a patrol strategy that renders an optimum manpower distribution through total participation of the police organization. Obviously, the strategies component in this practical method can be equated to the "organization-environmental learning" stage in the conceptual model. Both parts involve an attempt to integrate the organization with the environment. In practical application, this interprets into learning how to assimilate allocation design and patrol strategy. The environment is altered during the "implementation" stage or allocation component, hence the organization learns to improve deployment further by complementing this change with an amenable patrol strategy. Such a process is seen as an organizational action intended to meld objectives with surrounding influences.

Decision. This step is similar to the "adaptation" stage. It represents the final response of the organization to effectively cope with change started earlier in the implementation process. Here,

final manpower adjustments are integrated with the strategies component to result in a design of optimum effectiveness through equalized workload and total participation. For the police organization, this step may call for an increase or decrease in overall personnel, resources, and equipment, depending on the degree of change necessary to adapt to new contingencies and situations. Ideally, as in the conceptual model, this step is totally integrated with the learning process so that maximum foresight and flexibility can be attained in matching environmental pressures.

Evaluation. Following the principle that a model for decision-making applied to the deployment of police personnel must not be done once and then forgotten, the evaluation step acts as a monitoring device to remind organizations of current change. This necessitates the periodic examination of environmental features and criminal-incident patterns.

The patrol force distribution should be evaluated quarterly or once every three months. Similar to the "feedback" stage, evaluation permits the continual updating of information on which deployment is based. For the most part, changes will be subtle for small to medium-size police departments; however, through a careful analysis, the police administrator will be able to observe them and then anticipate the police service that will be required in the future, for truly, "what is past is prologue."⁶

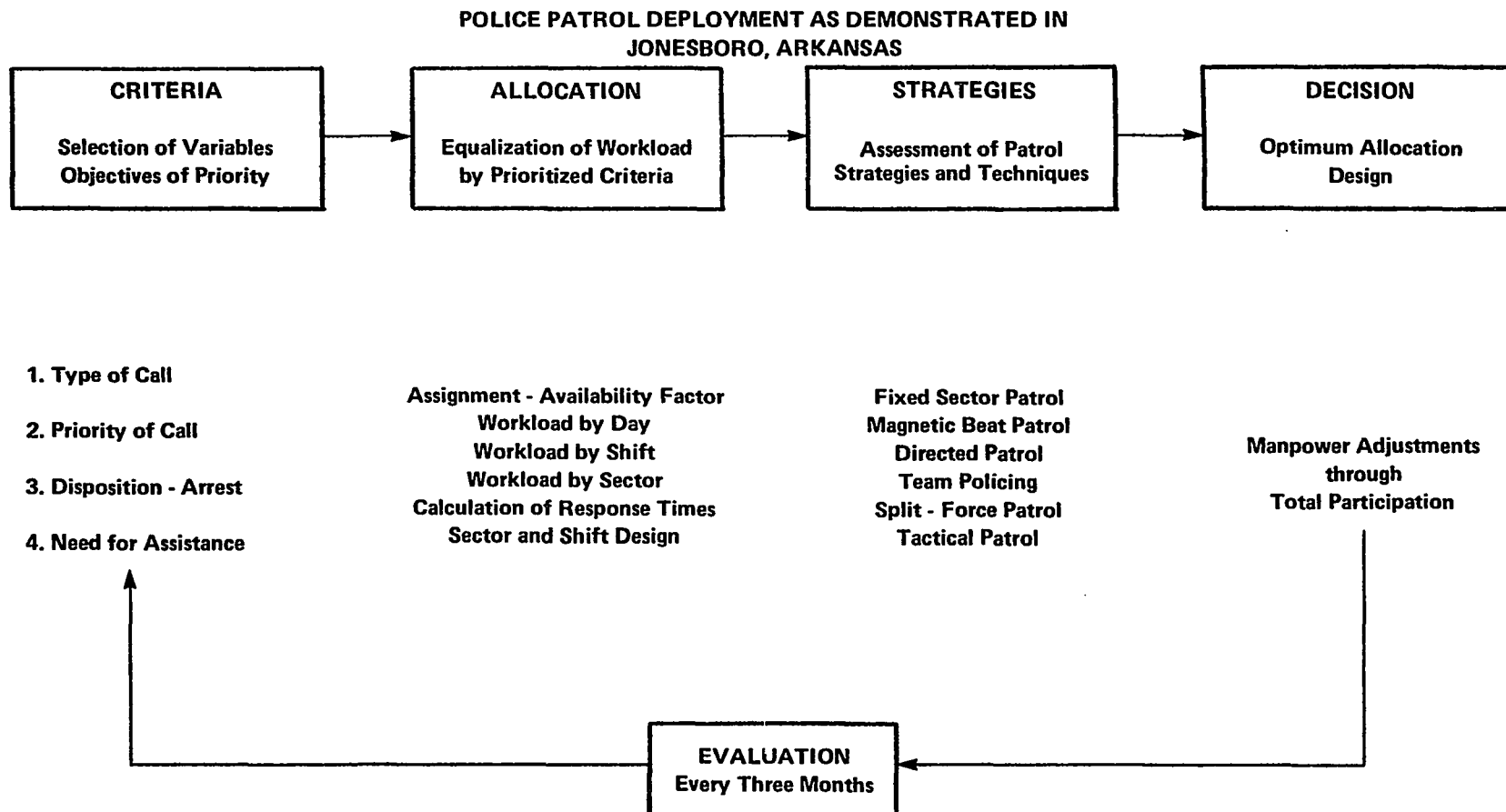
Additionally, evaluation consists of analyzing what the current organizational objectives are in relation to environmental influences and demands. Evaluation, therefore, consists of deciphering those signals that suggest changes in the organization. For example, police

departments have traditionally failed to incorporate political and economic conditions in planning for manpower deployment. However, as exhibited in many cities today, there exists a relationship between crime patterns and employment rates or between service demands and poverty levels.⁷ Evaluation and information feedback assists the police organization in refining these relationships as well as identifying those areas of potential concern.

Figure 2 displays a schematic of the patrol deployment method as derived from the theoretical model--Integrated Management Decision-making. The following discussion sets forth those decision-products obtained by the application of this model to the Jonesboro, Arkansas Police Department.

The Test Case: Jonesboro, Arkansas

The City. The City of Jonesboro, in northeastern Arkansas, with a population of 32,000, is the center of an urban community of over 65,000 people. An agriculturally-based trade city, it is the headquarters of Riceland Incorporated, and boasts the largest rice mill in the world as well as other substantial grain processing facilities. It supports several large industrial complexes such as DuPont manufacturing, General Electric engineering, and Krueger publishing. While Jonesboro has attempted to maintain a diverse economic base, agriculture and farming still remains the singular, most important labor market. Subsequently, with the rise in interest rates and a poor national economy, coupled with a severe 1979-1980 drought, Jonesboro (along with the rest of Arkansas) is undergoing a period of economic decline.



**FIGURE 2: A METHOD FOR DEPLOYMENT DERIVED FROM
INTEGRATED MANAGEMENT DECISIONMAKING**

In many ways, the city is atypical of the South. Over 90 percent of the city's population is white and only 7 percent of the population is black.⁸ The vast majority of the population is native-born to the Ozark regions of lower Missouri and Arkansas, and settled in Jonesboro where centralized trade and farming offered employment opportunities. In 1979, the Bureau of Census ranked Arkansas 49th out of the 50 states having the lowest average earned income, head of household at \$6,785.00.⁹

The government of Jonesboro is similar to other cities having a city council and mayor, with exception to the prolific number of councilmen. There are 12 aldermen who sit as heads of various committees and departments within the administration and a mayor with over 15 years experience as chief executive.

The crime rate in Jonesboro is well below the national average and the average for all cities of population 25,000 to 49,999. Refer to Table 1.

TABLE I
RATE OF INDEX OFFENSES KNOWN TO POLICE, 1979
PER 100,000 POPULATION

	<u>National Average Non-Metro Cities</u>	<u>Arkansas</u>	<u>Jonesboro*</u>
Total	4364	3621	1748
Violent	285	366	66
Property	4079	3255	1682

*Based on Jonesboro, Arkansas residential populations of 25,000.

Calculated from Jonesboro Police Department Records and FBI Uniform Crime Reports, 1979.

Residents of the city proclaim that such a low crime phenomena is the result of religious rebirth. Situated in the "Heart of the Bible Belt," Jonesboro supports over 100 separate churches, the main denomination being of Southern Baptist extraction. The religious tempo of the city is credited for denying the dispensing or selling of alcoholic beverages in the county. Jonesboro is a "dry" city.

However, other reasons drastically effect the low reported crime rate in Jonesboro which are not highly publicized. First, there are two means by which crime activity is documented. One of these methods is the simple tabulation of "incidents reported to police." The other is a classification of "crimes under investigation." It appears that the Jonesboro Police Department reports (to the FBI) only those crimes falling within the second category. Criminal incidents which do not have obvious follow-up leads or investigative directions and which are of a minor consequence, (such as bicycle thefts, simple vandalisms, and minor fights) are simply forgotten and rarely addressed. Secondly, while conducting research at the Jonesboro Police Department, the author became aware of several criminal incidents which were brought to the attention of the police, however, never formally reported. The major reason for this second failure is tied to the problems produced by the first. Jonesboro police officers are very cognizant of the department's procedure regarding follow-up investigations. Knowing that little, if any, investigation would ever result from the incident report; officers simply do not take the report for reasons of expediency. As one officer stated, "Why take the report . . . nothing is going to come of it anyway."

The Police Department. The Jonesboro Police Department is an urban law enforcement agency consisting of 44 sworn personnel, having jurisdiction over a 40 square mile area.¹⁰ It is headquartered in the Justice Complex which serves as housing for the district and circuit court as well as the police department. Security is very relaxed, with an attitude of "being friendly" more important than taking necessary safeguards. For this reason, the radio-dispatcher often acts as receptionist simultaneously, and police cars as well as front doors are rarely locked.

The department is headed by a retired FBI agent native to the area. Refer to Figure 3 for an organizational chart of the department. There is no civil service or police union and hiring and promotion is a discretionary move by the Chief. Jonesboro patrol officers are severely underpaid at \$11,860.00 per year as compared to other similar department officers.¹¹ Further, the Chief has consistently requested additional manpower and equipment increases with little avail. All in all, these factors have led to poor morale among officers and a cynical attitude regarding change.

However, after just one year of appointment, the Chief has made continual progress in improving supervisor-officer relations, management techniques, records and data collection, investigative procedures, and patrol deployment.

Decision-Products

This presentation shows the relationship between the current manpower deployment design utilized in Jonesboro and the proposed design based upon the calculations of equalized workload and multiple

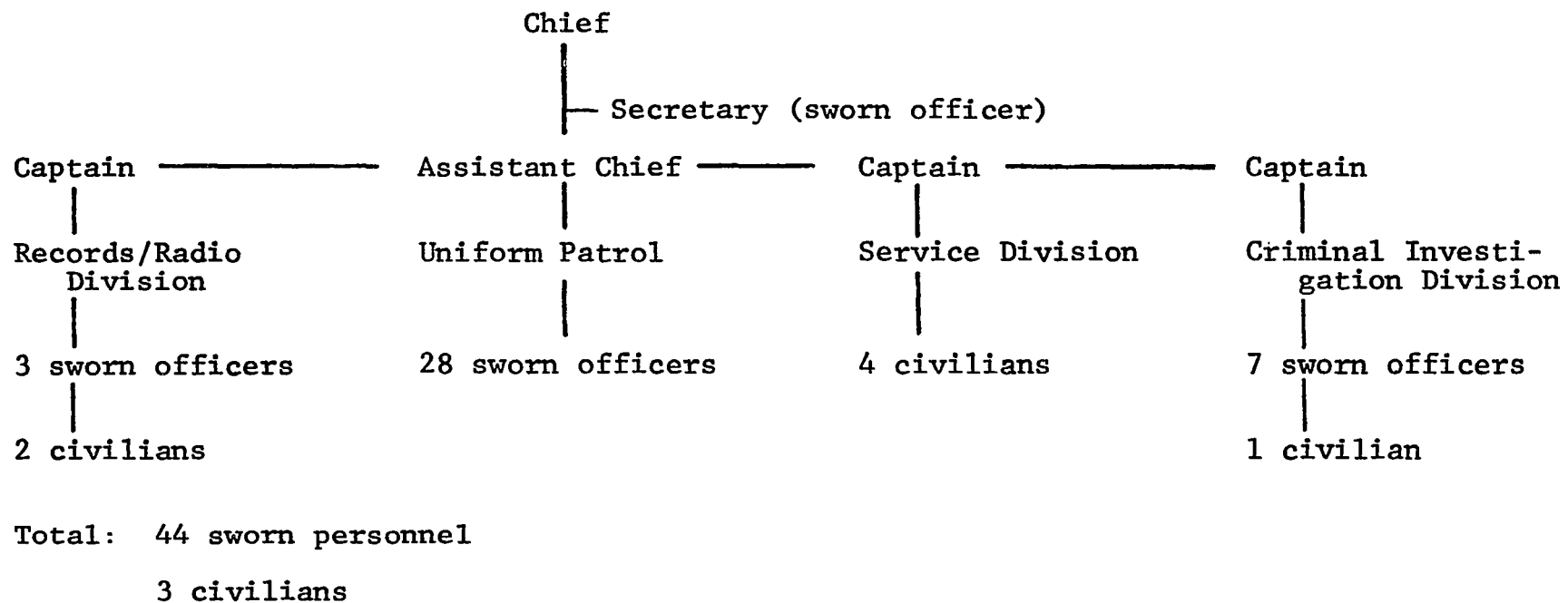


Figure 3: Organizational structure

response indices. Disparities between the two designs are emphasized by statistical procedure, specifically the Kruskal-Wallis Test in sector pattern and percentile variance in shift scheme.

Assignment-Availability Factor.¹² For every day of the year, twenty-four hours a day, there exists a manpower need for police agencies. The potential need in a patrol force is eight hours a day, three times a day. Each patrol officer is required to work eight hours a day. Each patrol officer is required to work eight hours a day for five consecutive days in the Jonesboro Police Department. This is a common assignment period per officer found throughout police agencies. Further, each officer is assigned a beat, and the beat is manned for each tour of duty. However, in reality, no officer will man his sector each day of the year because of several factors.

Before any deployment plan can be designed, a need arises to know the actual assignment-availability factor to man one sector once every eight hours for 365 days. To determine the number of officers necessary to man each beat at all times, it is necessary to find out in hours what is potentially available and what is actually available due to loss of officer time because of extenuating circumstances.

These circumstances or factors are generally universal to all police agencies, including the Jonesboro Police Department. They are regular days off, vacations, sick time, training, holidays, military leave, court time, special details, officer suspension, and any other loss of time that may have a significant effect on availability of personnel. To calculate the potential need for available hours for one officer, the following formula is applied:

Number of days/year X Number of hours in a shift

$$365 \times 8 = 2,920 \quad \text{potential hours available} \\ \text{per officer per year}$$

From the computation of 2,920 potential available hours per officer per year, it is possible to calculate an assignment-availability factor needed to man one sector for eight hours each day, 365 days a year. Using the Jonesboro Police Department individual circumstances and averages, a factor of 1.85 is computed. In simple terms this factor means that it requires the Jonesboro police agency to have 1.85 officers available to man one sector for eight hours for 365 days or 5.55 officers to man one sector for twenty-four hours a day for 365 days. Refer to Table II for an outlay of relevant data and computed assignment-availability factors.

Thus, the typical Jonesboro police officer works five days a week, and eight hours a day, assigned to one sector. There are currently four sectors in Jonesboro to be manned per shift. This computes into a need of 22.2 men available each day for patrol. Referring to Table III, it is observed that this need is statistically met.

However, the original number of total men available for patrol is erroneous. Lieutenants are rarely assigned patrol sectors on a shift; their duty period is filled with supervisory, administrative and managerial tasks. Further, a Selective Traffic Enforcement Program utilizes two officers per shift or a total of six men. Table IV reveals that a maximum of 19 officers are available currently to man four sectors per shift twenty-four hours a day, 365 days a year. This is three men short of the calculated available-assignment factor for the Jonesboro Police Department. Refer to Table IV.

TABLE II
DATA AND COMPUTATION FOR ASSIGNMENT - AVAILABILITY FACTOR
JONESBORO POLICE DEPARTMENT*

POTENTIAL HOURS AVAILABLE 2,920

Circumstances under Consideration:

Vacation Time (15 days X 8 hours)	120
Regular Days Off (102 days X 8)	816
Sick Time (20 days X 8)	160
Training or Inservice (4 days X 8)	32
Holidays (12 days X 8)	96
Court Time (8 days X 8)	64
Military Leave (7 days X 8)	56
Suspensions, Discipline	?
Line of Duty Injury	<u>?</u>
TOTAL:	1,344

Remainder = 2,920 - 1,344 = 1,576

Assignment - Availability Factor = $\frac{2,920}{1,576} = 1.85$

*Based on 1980 averages and figures.

TABLE III

ASSIGNMENT - AVAILABILITY FACTORS
28 OFFICER PATROL FORCE
JONESBORO POLICE DEPARTMENT

POTENTIAL MAN - DAYS AVAILABLE (365 days X 28) 10,220

Vacation (15 days X 28) 420

Regular Days Off (102 days X 28) 2,856

Sick Time (20 days X 28) 560

Training (4 days X 28) 112

Holidays (12 days X 28) 336

Court Time (8 days X 28) 224

Military Leave (7 days X 28) 196

Suspensions, Discipline ?

Line of Duty Injury ?

TOTAL: 4,704

Remainder - 10,220 - 4,704 = 5,516

Assignment - Availability Factor = $\frac{10,220}{5,516} = 1.85$ officers

Assignment - Availability Factor for 3 shifts = 5.5 officers

Assignment - Availability Factor for 4 shifts = 22.2 officers

Current Patrol Manpower = 28.0 officers

TABLE IV
CORRECTED ASSIGNMENT - AVAILABILITY FACTORS
JONESBORO POLICE DEPARTMENT

Current Patrol Manpower	28 officers
Lieutenants	3
Selective Traffic Enforcement	6
Actual or Real Patrol Force	19 officers
Corrected Assignment - Availability Factor	22.2 officers
Need (Manpower Increase)	3 officers
<hr/>	
Calculated Assignment - Availability Factor	
with proposed five man increase	
(includes Lieutenants and Selective Traffic Enforcement)	
	32.4 officers
Jonesboro Patrol Manpower	
(with proposed five man increase)	33 officers

Thus, to maintain the current sector design, a manpower increase of three men is mandatory. For purposes of this dissertation, it is assumed that all manpower requests will be granted. Deliberation is currently on-going in the Jonesboro City government for a manpower increase of five officers (it is expected to be fulfilled). Therefore, the corrected total number of available men for patrol is 33 officers; which realistically and statistically meets a corrected available-assignment factor of 32.4 officers within the Jonesboro Police Department. Refer to Table IV.

Shift Determination and Manpower Distribution. The Jonesboro police officer works a traditional five days a week, and eight hours each day. This is forty working hours per week per man. There are 33 officers of all ranks in the department (3 lieutenants, 6 sergeants, and 24 officers) available for patrol services.¹³ Allowing one lieutenant per shift, this would mean 30 officers times 40 hours, or 1,200 man-hours of patrol force service per week.

This section addresses the distribution of these 1,200 man-hours of patrol service over the 168 hours of the seven-day week. The goal is to provide an optimum arrangement of working hours by shift that would cause equalization of workload within shifts. Several variables will be studied regarding shift variance. These are the number of calls by month, the number of type of calls by day, the multiple response indices by day, shift differences in response time, number of calls by time and multiple response indices by time. An average hourly workload will be calculated based on multiple response indices and a within-shift variance will be computed for each set of shift time.

1. Number of Calls by Month. This frequency count is important as it shows variation between seasons. Obviously, some variation is expected. However, if extreme differences occur between months then an indication of altered manpower needs is required. Table V displays the number of calls by month.

On observing Table V, it can be concluded that little variance is present between months. The standard deviation is low as well as the variance.

It is noteworthy to observe that the summer months of June, July, August, and September reflected the most demand of police services. This is indicative of national trends displayed in the FBI Uniform Crime Reports for the last several years.¹⁴

2. Number of Calls by Day. This frequency count displays number of calls by day of week. It graphically displays which days require the most police service. Refer to Table VI.

Friday and Saturday, again coinciding with national patterns, display the highest need for police manpower.¹⁵ For the purposes of manpower distribution, it is important to split week-ends off. In other words, no one man receives both Friday and Saturday as regular days off. This will ease personnel desires as part of the week-end is "free" and allow a more equitable method of achieving maximum police service on those respective days. Changing days off is always a touchy subject among police officers. Everyone would like to have Friday and Saturday evening off, however, peak service is required on those days. To accommodate both equity among officer's days off and police service need, seniority should govern this issue.

TABLE V
NUMBER OF CALLS BY MONTH, 1980
JONESBORO POLICE DEPARTMENT

	Frequency	Relative Percentage
January	687	8.2
February	583	7.0
March	669	8.0
April	629	7.5
May	705	8.6
June	766	9.2
July	800	9.6
August	810	9.7
September	708	8.5
October	705	8.4
November	614	7.4
December	<u>650</u>	<u>7.9</u>
Totals:	8,326	100.0
Standard Deviation:	68.23	

TABLE VI
NUMBER OF CALLS BY DAY - 1980
JONESBORO POLICE DEPARTMENT

	<u>Frequency</u>	<u>Relative Percentage</u>
Monday	1,192	14.3
Tuesday	1,193	14.3
Wednesday	1,047	12.6
Thursday	1,133	13.6
Friday	1,371	16.2
Saturday	1,308	15.7
Sunday	<u>1,082</u>	<u>13.0</u>
Total:	8,326	100.0

Standard Deviation: 116.95

To check the tabulations of calls by day, a second frequency was computed. The difference being a plot of multiple response indices (instead of calls for service) against day of week. Figure 4 is a graphical display reinforcing the need for maximum police service on Friday and Saturday.

3. Shift Assignment. The next step is to determine the optimum arrangement of working hours by shift based again, on multiple response indices set by the police manager. The shift hours selected should be those that have least variation in workload between hourly peaks and valleys regarding activity. This method will allow for the assignment of officers by shift, thus reducing the possibility of having too many or too few officers on duty at any given time.¹⁶

Table VII reflects the frequency of number of calls by hour by current shift. An extremely low chi-square and high variance supports

Multiple Response
Index

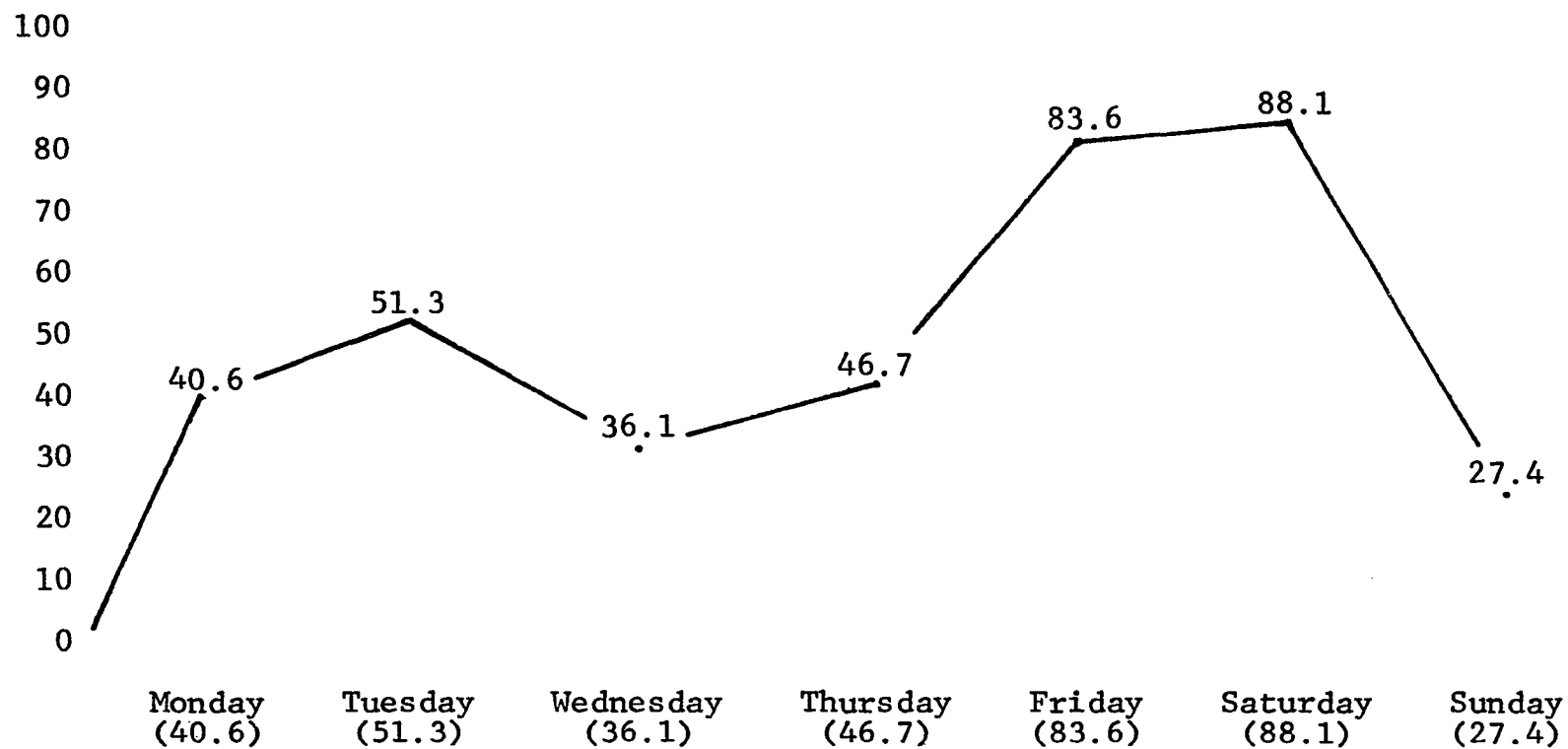


Figure 4: Graphical display - multiple response indices by day of week.

TABLE VII
NUMBER OF CALLS BY HOUR BY CURRENT SHIFT, 1980
JONESBORO POLICE DEPARTMENT

	<u>Frequency</u>	<u>Relative Percentage</u>
Morning Shift:		
7:00 a.m. - 7:59 a.m.	227	2.7
8:00 a.m. - 8:59 a.m.	324	3.9
9:00 a.m. - 9:59 a.m.	299	3.6
10:00 a.m. - 10:59 a.m.	309	3.7
11:00 a.m. - 11:59 a.m.	322	3.9
12:00 noon - 12:59 p.m.	322	3.9
1:00 p.m. - 1:59 p.m.	419	5.0
2:00 p.m. - 2:59 p.m.	<u>408</u>	<u>4.9</u>
Subtotals:	2630	31%
Afternoon Shift:		
3:00 p.m. - 3:59 p.m.	376	4.5
4:00 p.m. - 4:59 p.m.	438	5.3
5:00 p.m. - 5:59 p.m.	431	5.2
6:00 p.m. - 6:59 p.m.	427	5.1
7:00 p.m. - 7:59 p.m.	441	5.3
8:00 p.m. - 8:59 p.m.	478	5.7
9:00 p.m. - 9:59 p.m.	538	6.5
10:00 p.m. - 10:59 p.m.	<u>529</u>	<u>6.4</u>
Subtotals:	3656	44%
Night Shift:		
11:00 p.m. - 11:59 p.m.	547	6.6
12:00 mid. - 12:59 a.m.	415	5.0
1:00 a.m. - 1:59 a.m.	339	4.1
2:00 a.m. - 2:59 a.m.	242	2.9
3:00 a.m. - 3:59 a.m.	163	2.0
4:00 a.m. - 4:59 a.m.	124	1.5
5:00 a.m. - 5:59 a.m.	110	1.3
6:00 a.m. - 6:59 a.m.	<u>100</u>	<u>1.2</u>
Subtotals:	<u>2040</u>	<u>25%</u>
TOTALS:	8326	100%

Standard Deviation: 132.45

Chi-Square: 2.6 at 21 degrees of freedom

Significance: .01

the conclusion that a systematic relationship does not exist between shifts, hence the variables of shift hours and calls for service are independent. Further, observation reveals that 44 percent of the calls occur on the afternoon shift and that the hours of 9:00 p.m. to 12:00 midnight are the peak time of police demands. This follows a national pattern.¹⁷

Comparing different shift assignments by calls for service, it is observed that the existing shift times are not the most equitable in terms of workload. See Table VIII. While the 6:00 a.m. to 2:00 p.m. shift rotation appears to have a more equalized percentage, it is important to realize that this data only reflects a single variable frequency. A much better shift scheme can be realized by plotting a multiple variable conglomerate against each shift rotation. If the multiple response indices are tabulated for hourly workload, segmented into shift rotations and computed for least within-shift variation; a more accurate diagram of equalized workload will appear. Figure 5 displays such a computation.

Donald T. Shanahan indicated that if optimum change-of-shift time should be on such non-traditional hours, such as exhibited in this data and in Figure 5, the difference in variance may be so minor that what might be gained in efficiency would be lost in personnel morale and organizational conflict.¹⁸ It should be strongly noted that the 4:00 a.m. to 12:00 noon shift rotation reveals the least percent of within-shift variance, however, the difference from that of the current 7:00 a.m. to 3:00 p.m. rotation is only three points. Under these circumstances, the data would suggest that current shift hours be maintained, and that alternative strategies be employed to allow

TABLE VIII
SHIFT ASSIGNMENT BY CALLS FOR SERVICE, 1980
JONESBORO POLICE DEPARTMENT

	Frequency	Relative Percentage
5 a.m. - 1 p.m.	2013	24
1 p.m. - 9 p.m.	3418	41
9 p.m. - 5 a.m.	2895	35
6 a.m. - 2 p.m.	2322	28
2 p.m. - 10 p.m.	3537	42
10 p.m. - 2 a.m.	2569	30
7 a.m. - 3 p.m.	2630	31
3 p.m. - 11 p.m.	3656	44
11 p.m. - 3 a.m.	2040	25
8 a.m. - 4 p.m.	2779	33
4 p.m. - 12 mid.	3827	46
12 mid. - 8 a.m.	1720	21
9 a.m. - 5 p.m.	2893	34
5 p.m. - 1 a.m.	3804	46
1 a.m. - 9 a.m.	1629	20
10 a.m. - 6 p.m.	3025	36
6 p.m. - 2 a.m.	3712	45
2 a.m. - 10 a.m.	1589	19

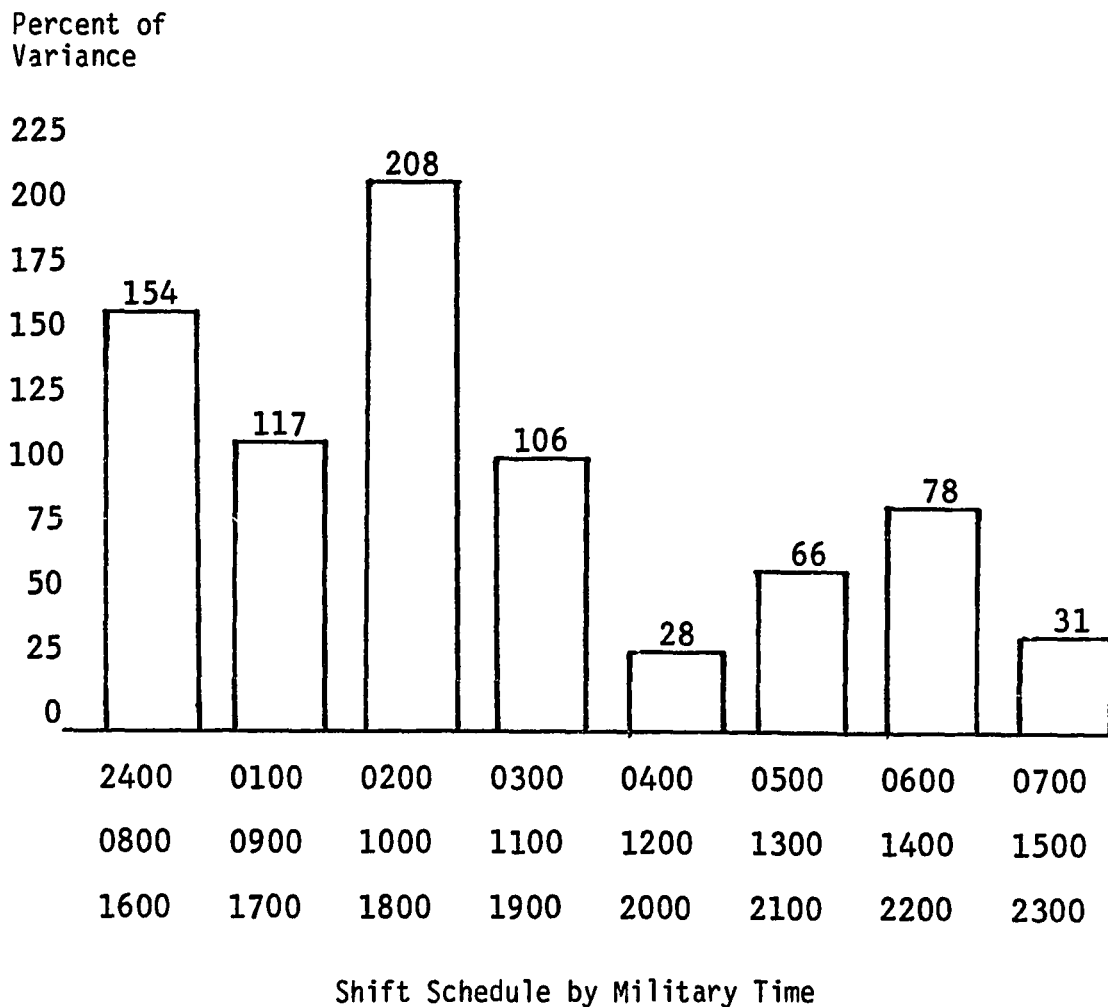


Figure 5. Histogram: Least Variance of Multiple Response Indices by Shift Schedule

for more officers on the afternoon or swing shift to handle the increased workload.

As Warren G. Bennis so aptly put it, successful change within an organization is dependent on the ability to identify and mold "strategic variables" such as the "resistance and adaptation" to a planned move.¹⁹ The realization that police officers are people and that production is a behavior, counters strict decisions made on quantification alone. People-oriented managers need to balance

decisions between people and production. The long-range result will usually be maximum benefits. Changing shift rotation to the 4:00 a.m. to 12:00 noon scheme would have drastic organizational affects. The 7-3-11 shift change should be maintained.

Sector Requirements and Design. There are currently four patrol sectors existing in the Jonesboro city limits. The boundaries for these sectors have been so established for over five years. There has never been a statistical study or justification for the design of patrol sectors within the city. Major roadways are the boundaries for each district and the city is divided into somewhat equal geographical areas, comprised of sectors north, east, west, and middle. Figure 6 displays a map of the City of Jonesboro by sector.

These established sector boundaries can be easily moved to accommodate change that would result in improvement for one or more of the following conditions:

1. Improved response time average for a given sector.
2. Decrease in dispatches of police units outside of their assigned sector.
3. Increased officer safety by increased back-up units.
4. Decrease in gas consumption because of efficient manpower deployment regarding travel time to known high police service areas.
5. Improved administration through consolidation of sectors.
6. Equalized workload balance among patrol officers.

As discussed in Chapter I of this dissertation, extensive work has been done on the development of complex deployment designs by use of computer modeling, probability factors, and travel-time schemes.

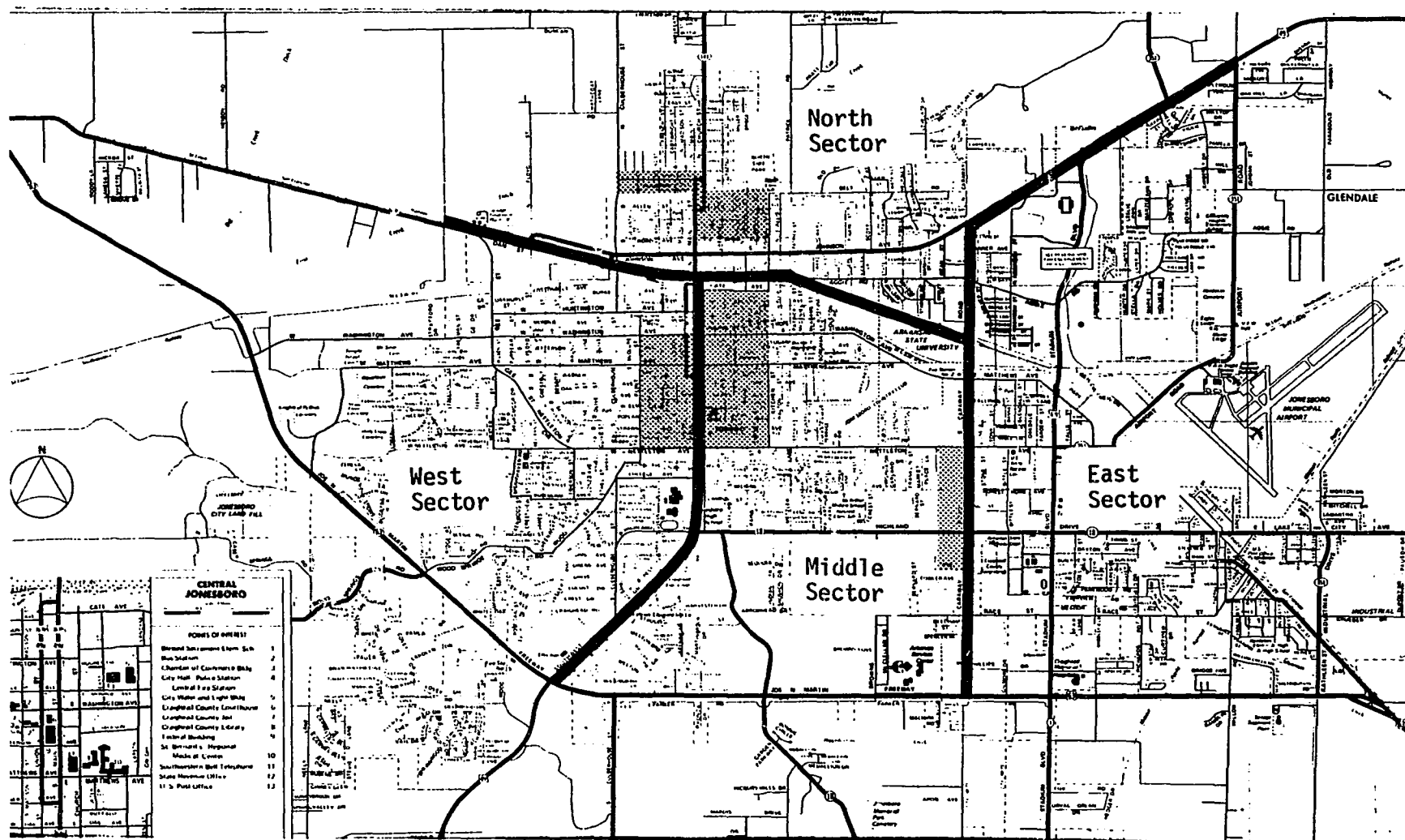


Figure 6: Map of Jonesboro, Arkansas: Current Sector Design
Shaded areas represent high multiple response index locations.

One focus of this study centers on the design of patrol sectors based on criteria established in multiple response indices by the police manager.

The first step in accomplishing this task is generated in the establishment of 57 one and one-half inch square geographical locations representing .5 square miles of the city. The multiple response index for each of these geographical locations is tabulated.

For a simplified explanation of the multiple response index calculation performed by the SPSS subprogram Multiple Response Analysis, Table IX is presented.

The Kruskal-Wallis Test is selected to test whether the four independent, sector geographical locations are from different populations; or if the workload between sectors is proportionately different between medians. Each Multiple Response Index is tabulated and ranked from 1 to N. The value of R (the sum of ranks) for each of the sector multiple response indices are then determined.

The approach procedure for making a decision as to the acceptance or rejection of the null hypothesis is strictly followed as presented in objective statistical tests in research.²⁰ Hence, Table X is presented and the following method is employed.

As previously stated, it was hypothesized that the medians of the multiple response index population are equal. This hypothesis describes a relationship between the four existing multiple response indices, correspondingly, one to each district currently employed by the Jonesboro Police Department.

H was computed by means of the formula:²¹

TABLE IX
COMPUTATION OF MULTIPLE RESPONSE INDEX PER CALL*
(8,326 police calls)

MRI = TYPE OF INCIDENT	+ PRIORITY	+ ARREST	+ COVER
5(weight) X 4(factor) + 3(weight) X 3(factor) + 3(weight) X 2(factor) + 2(weight) X 1(factor)			
4(weight) X "	+ 2(weight) X "	+ 2(weight) X "	+ 1(weight) X "
3(weight) X "	+ 1(weight) X "	+ 1(weight) X "	
2(weight) X "			
1(weight) X "			

* This is a simplified theoretical explanation of the MRI value for each of the 8,326 calls. The summation of these values are tabulated for each of the 57 geographical locations comprising the City of Jonesboro, Arkansas.

TABLE X

ORIGINAL SECTOR DESIGN: MULTIPLE RESPONSE INDICES
FOR FOUR SECTORS. DATA FOR COMPUTATIONS,
KRUSKAL-WALLIS ANALYSIS OF VARIANCE BY RANKS.

SECTORS							
NORTH		EAST		WEST		MIDDLE	
MRI	Rank	MRI	Rank	MRI	Rank	MRI	Rank
2.38	32	42.12	56	.04	2	54.43	57
12.56	48	5.68	40	.19	11	17.68	50
22.87	51	.63	21	.34	16	26.31	53
.70	22	4.35	39	1.65	29	9.93	45
25.89	52	10.61	46	3.18	37	26.32	54
.27	13.5	2.91	35	1.70	30	6.49	41
.87	27	8.38	43	.81	26	8.46	44
.75	24	11.81	47	.06	4	.27	13.5
.78	25	2.92	36	.11	8	.46	18
.08	6	1.77	31	.16	10	28.25	55
15.46	49	2.87	34	.07	5	.75	24
6.63	42	.20	12	.09	7	2.51	33
3.68	38	.30	15				
		.35	17				
		.74	23				
		1.09	28				
		.05	3				
		.03	1				
		.14	9				
		.51	19				
N=13	$R_1=429.5$	N=20	$R_2=555$	N=12	$R_3=185$	N=12	$R_4=487.5$

$$H = \frac{\frac{12}{N(N+1)} \sum_{i=1}^k \frac{R_i^2}{N_i} - 3(N+1)}{1 - \frac{\sum T}{N^3 - N}}$$

Where N_i and N represent the number of cases in the i^{th} category and in the total sample respectively. The denominator represents a correction for ties, where

$$T_i = t_i^3 - t_i$$

t_i being given the number of observations tied for a given rank.

Hence, the calculation of H for the original sector design of Jonesboro, Arkansas is:

$$\begin{aligned} H &= \frac{12}{3,306} \left[\frac{(429.5)^2}{13} + \frac{(555.0)^2}{20} + \frac{(185.0)^2}{12} + \frac{(487.5)^2}{12} \right] - 174 \\ &= \frac{12}{3,306} (52,248.01 - 174) \\ &= 189.64 - 174 \\ H &= 15.64 \end{aligned}$$

Correction for ties

$$H = \frac{15.64}{1 - \frac{6}{(573-57)}}$$

Referring to a chi square table,²² for 3 degrees of freedom ($k-1$), a chi square of 7.82 or larger is needed to obtain significance at the .05 level. Since an H of 15.64 was obtained from calculation of original sector design (multiple response indices), a decision is made to reject the null hypothesis.

Thus, the medians of the multiple response indices are not equal, displaying large discrepancies in workload between sectors. Observation of Table X and a calculated H of 15.64 statistically indicate that at least one sector median is disproportionately greater than the others. From a management perspective, this interprets into varied workload for officers as well as increased gas resources to cover "busy" patrol units. A more equitable workload between sectors is desired, if possible due to geographical considerations.

By manipulating the current sector boundaries in an attempt to equalize MRI workload, the Kruskal-Wallis Test can again be employed to test population medians. Further, a comparative analysis between the two test runs can be conducted until a lower value of H is determined. The maximum statistical goal is to achieve an H which is lower than a chi square of 7.82 at 3 degrees of freedom, taking into account sector barriers and geographical design.

A proposed sector design is revealed in Figure 7. By dropping the southern boundary of North Sector by one-half mile and extending the Eastern boundary of Middle Sector by one-half mile, four new patrol districts can be made which are geographically sound, similar in population density, and alike in beat area.

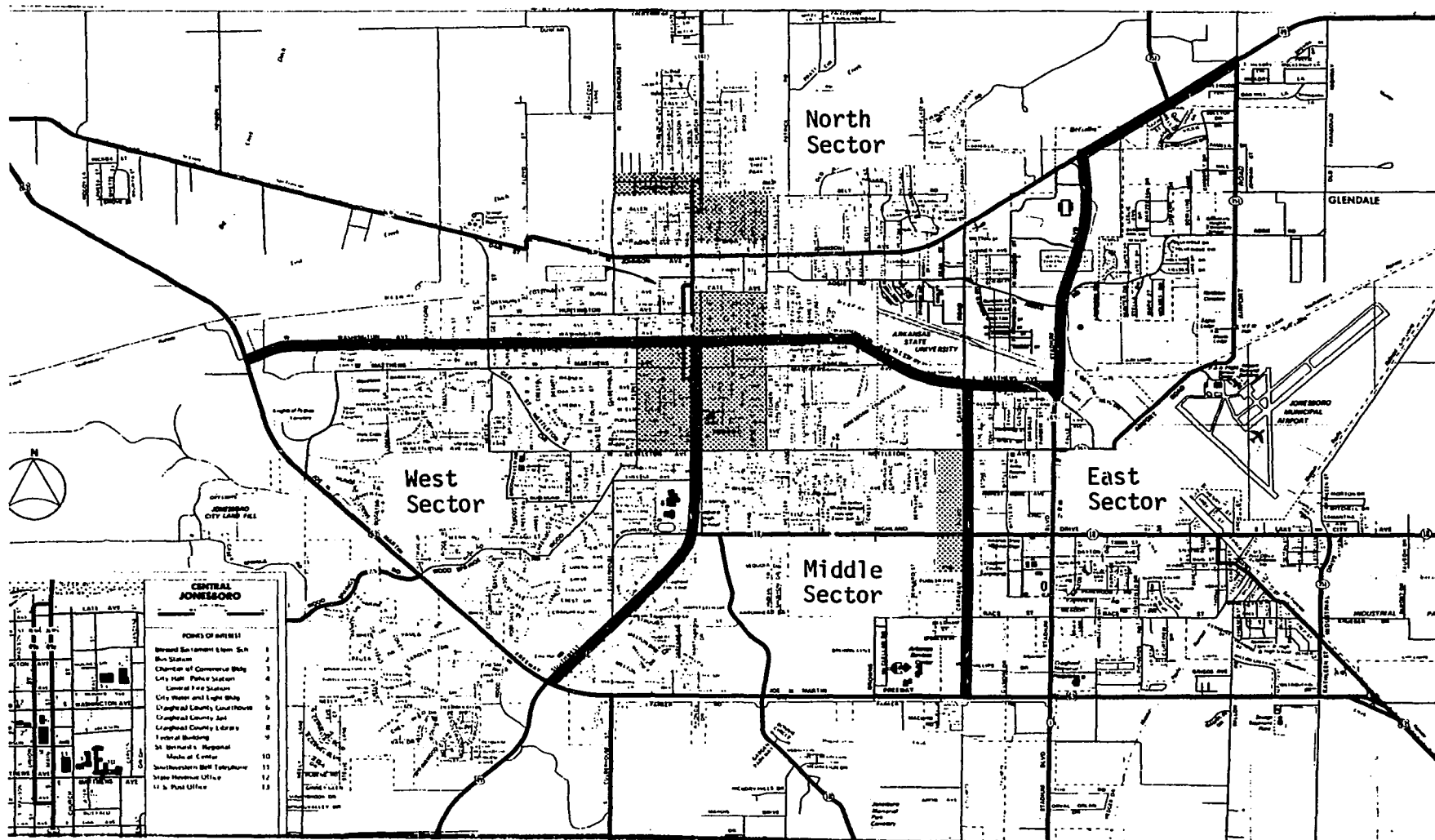


Figure 7: Map of Jonesboro, Arkansas: Proposed Sector Design
Shaded areas represent high multiple response index locations.

If the same procedures utilized to calculate the Kruskal-Wallis Test are employed for the new proposed design, a second value of H can be computed. It is important to note that each geographical grid was originally designed to be bound by major streets and thoroughfares in anticipation of patrol sector redesign. The same geographical grids were used and none were split or manipulated in any way. Only the summation or number of grids within each sector changed as boundaries were moved to include or exclude new or old geographical locations.

Table XI is presented to show the data derived from the proposed sector design. It is important to note that North sector has increased in number of geographical locations as all others have decreased; subsequently beat area has followed the same pattern.

Again employing the scientific method for approved research procedures in computing the Kruskal-Wallis Test, it is observed that a much lower H is achieved. In fact, an H of 3.94 is computed. Referring to a chi square table,²³ for 3 degrees of freedom (k-1), a chi square of 7.82 or larger is needed to obtain significance at the .05 level. Since an H of 3.94 was obtained, a decision not to reject the null hypothesis is supported.

From this decision it is possible to conclude that there is no meaningful difference between sector medians (or between sector MRI workload); and certainly no statistical difference as an H of 3.94 approaches a .30 probability factor that random error has no effect on data re-examination.

Therefore, in comparing the proposed sector design to the original design, a more equal workload balance among patrol officers is statistically proven.

TABLE XI

PROPOSED SECTOR DESIGN: MULTIPLE RESPONSE INDICES FOR
FOUR SECTORS. DATA FOR COMPUTATIONS,
KRUSKAL-WALLIS ANALYSIS OF VARIANCE BY RANKS.

SECTORS							
NORTH		EAST		WEST		MIDDLE	
MRI	Rank	MRI	Rank	MRI	Rank	MRI	Rank
2.38	32	42.12	56	.19	11	54.43	57
28.25	55	5.68	40	.34	16	17.68	50
12.56	48	.63	21	1.64	29	6.49	41
22.87	51	4.35	39	3.18	37	26.31	53
.70	22	15.46	49	2.51	33	8.46	44
25.89	52	10.61	46	1.70	30	.61	20
.27	13.5	2.91	35	26.32	54	9.93	45
.87	27	8.38	43	6.63	42	.46	18
.75	24	11.81	47	3.68	38	.27	13.5
.78	25	2.92	36	.81	26	.09	7
.08	6	1.77	31	.16	10		
.05	3	2.87	34				
1.09	28	.20	12				
.14	9	.30	15				
.06	4	.35	17				
.11	8	.74	23				
.04	2	.03	1				
.07	5	.51	19				
N=18	$R_1=414.5$	N=18	$R_2=564$	N=11	$R_3=326$	N=10	$R_4=348.5$

In support of this conclusion, an analysis of response time by sector is conducted. After determining individual sector response times within the original design, the data is manipulated to reflect the new locations of the proposed design by sector. The results are displayed by Table XII.

Even though the mean average response times are lower for the proposed sector design, the relationships appear to be somewhat spurious. Since all data was taken from the year 1980, and response times calculated from the elapsed time a police unit was dispatched to the time it arrived, the boundaries of sectors had little or no affect. In reality, if the North Sector unit was dispatched to a call, it made no difference in elapsed time to arrival no matter if the call was within that particular sector or crossed several sector boundaries. Therefore, what these times reflect is the number of dispatched calls out of sector; since those call locations absorbed into different sectors were not calculated for the proposed sector response times.

Hence, it can be hypothesized that the frequency of outside sector call dispatches will decrease with implementation of the proposed sector design. From a practical sense, this interprets into increased officer safety as back-up units will have a higher probability of being closer to their respective sectors; and a savings in gas resource funds as patrol cars will be traveling less distance to dispatched calls.

Determination of Patrol Strategy

In the preceding discussion, several criteria for the allocation

TABLE XII

ORIGINAL VS PROPOSED SECTOR DESIGN: RESPONSE TIMES

ORIGINAL DESIGN

North Sector	4 minutes 26 seconds
East Sector	4 minutes 46 seconds
West Sector	5 minutes 28 seconds
Middle Sector	4 minutes 16 seconds
MEAN	4 minutes 44 seconds

PROPOSED DESIGN

North Sector	4 minutes 33 seconds
East Sector	4 minutes 31 seconds
West Sector	4 minutes 50 seconds
Middle Sector	3 minutes 42 seconds
MEAN	4 minutes 24 seconds

of police manpower by equalization of workload was established for the Jonesboro Police Department. An assignment-availability factor was determined, shift rotational schemes were discussed and maintained, month and day workload variations were studied, and a new sector design was proposed for the Jonesboro community. To this point, the emphasis on decision-making has been limited to direct input from the manager as to the establishment of multiple response indices. These inputs have acted as parameters for the careful analysis of determining a patrol allocation plan. Equally important to the administrator is the selection of a patrol strategy. As used here, patrol strategy refers to the particular combination of sector structure, area patrol coverage, and number of response or preventive force units which are being used in a police district each working period.²⁴

The purpose of this presentation is to discuss the relative merits of some patrol strategies in an attempt to suggest an enforcement method which will mold with the unique features of the established allocation plan for Jonesboro, Arkansas. The goal being to design an optimum manpower distribution, coupling allocation plan and patrol strategy, based on multiple response indices established by the police manager.

Fixed Sector Patrol. This patrol strategy is the typical beat structure in common use today and is exhibited in Jonesboro, Arkansas as it is in most cities. One patrol unit is assigned to each sector with no overlapping boundaries; however, patrol officers are frequently dispatched across boundaries when the need arises. The Fixed Sector Patrol technique is the traditional police response to random moving patrol cars in an attempt to deter crime. Officers are expected to answer any type of call or incident that occurs within

their respective sectors. There are no special units which handle certain calls (excluding traffic accident investigation and selective enforcement) and thus, each officer is responsible for his district.

In theory, Fixed Sector Patrol operates on the conclusion that crime occurs randomly over a given geographical area; and that a patrol car can give all parts of a specific district some patrol coverage or protection by moving randomly throughout the sector when not answering calls. In Chapter I of this dissertation, the concept of the random moving patrol car and crime deterrence received considerable question.

An additional premise promoted by Fixed Sector Patrol is equalization of workload and response time. The idea that workload can be evenly distributed by slicing a given area into districts is only partly correct. As described in the previous chapter, the City of Jonesboro was indeed segmented into relatively similar size sectors and workload was proven to be statistically uniform between these sectors. However, the workload per officer will continue to fluctuate unevenly between shifts. Considering that Jonesboro reflected a national trend of most police demand occurring between 9:00 p.m. and 12:00 midnight, it must be assumed that those officers working the afternoon shift (swing) will carry a much higher workload than those on the other two shifts. This is highly supported in Table VII. This is not meant to subjugate the Kruskal-Wallis Test analysis conducted earlier, only qualify and refine it. The researcher emphasizes that given this patrol technique, it appears that the best possible sector design was proposed.

Further, Fixed Sector Patrol advocates assume that a number of districts will insure a high probability that any person calling for help within the city will not be too far away from a patrol car for a quick response. Donald Shanahan points out an interesting phenomenon. He states that there is a "built-in conflict" between area, response time, and balanced sector workload in cases where some sectors have a high population density and others have a low population density.²⁵ If beats are designed so as to equalize work loads, those in low population density areas will be much larger and have longer response times. If they are designed to have roughly equal areas in order to make travel times equal, the high population density beats will have a much higher workload than the low density beats. While substantively correct, Shanahan fails to address small urban centers, such as Jonesboro. Additionally, the proposed sector design reflects four districts having extremely close area size and shape. Again, these arguments are not presented to undermine the statistical significance of the preceding discussion, only to refine it and highlight its strong points.

In conclusion, the Fixed Sector Patrol remains the classic technique in most cities. It has been tested, measured, and simulated many times by man and computer and still remains worthy in terms of patrol criteria.²⁶

Magnetic Beat Patrol. A second patrol method discussed is called "Magnetic Beat Patrol." This strategy was adopted by the Chicago Police Department in 1968 and is named after the "magnetic" affect high call beats have in "drawing" police calls to specific geographical locations.²⁷ In order to maintain a somewhat uniform patrol,

the procedure calls for police units to remain in the sector in which it last answered a call. The theoretical concept being that high call beats will attract cars where the need is greatest.

Under a light workload, the magnetic effect is not as predominant as with a heavy workload. Although the Chicago Police Department has had relative success in this patrol technique, it is questionable if criteria such as response time and travel distance to "magnetic" areas would greatly influence a small city jurisdiction having only four sectors.

Directed Patrol. Directed Patrol is a program developed by officers of the Kansas City, Missouri Police Department.²⁸ It has a primary goal of reducing specific crimes, usually residential burglary or armed robbery, in a given geographical location. The technique is often referred to as a meld of saturation patrol (flooding an area with police officers) and crime analysis (information indicating a pattern of specific criminal activity). Thus, officers are "directed" to patrol a specific location for a specific period of time in an attempt to apprehend or deter specific criminal types.

One of the characteristics of directed patrol is the implementation of a deployment system whereby workload is managed more effectively. Two methods are employed to allow more control of workload and reduce response time, thereby increasing the probability of apprehending a criminal as the act is occurring. First, calls are assigned a series of classifications based strictly on the priorities of: (1) Is the crime in progress? (2) Are the perpetrators present in the area? Secondly, the deployment system allows watch commanders and sector sergeants the flexibility to deploy resources according to

need within the present sector boundaries. It is quite obvious that the emphasis in Directed Patrol is on apprehension of criminals leading to the decrease of crime.

Directed Patrol, theoretically addresses the traditional police role of "criminal-catcher." It places little importance on the service aspect of police work, and concentrates on high crime rate areas. Crime specific analysis is an integral component to the program, as it provides continuous, detailed, and timely crime pattern information on which to support manpower deployment.

The inherent drawback to Directed Patrol is in police-community relations. Only a small percentage of the populus receive the greatest amount of police service. Equity of general police service to the community is sacrificed for an attempt to apprehend criminals by reduced response times. Capturing the essence of this discussion, Gourley and Bristow write:

Many patrol administrators who succumb to the temptation of concentrating patrolmen in high-crime areas are taken to task by merchants or citizens in light-crime areas, when patrolmen continually show excessive response time to their infrequent calls.²⁹

Such a condition would only be exaggerated in a small city where manpower and resources are severely limited. Directed Patrol offers guidance in those infrequent times that small urban centers experience a rash of specific crimes in specific areas. However, as a full time patrol strategy, it fails to meet the overall needs of a smaller jurisdiction.

Team Policing.³⁰ Team policing is a term that has meant something different in every city in which it has been tried. The

variations in style and form have been as numerous as the experimenters. In the past ten years, police jurisdictions such as Richmond, California; Multnomah County, Oregon; Dayton, Ohio; Detroit, Michigan; Los Angeles, California; and New York City have implemented some concept of team policing.

It will not be the purpose of this discussion to evaluate each experience, but to examine those operational elements of team policing which appeared somewhat uniform within each case; and which differ from conventional patrol concepts. These elements are: geographic stability of patrol, maximum interaction among team members, and maximum communication among team members and the community.

Geographic stability of patrol means the permanent assignment of teams of police to small neighborhoods. The geographic stability of patrol is the basic element to team policing. In small cities, such as Jonesboro, Arkansas, the entire city can be viewed as one large neighborhood and the police department divided into "teams" by shift. In any case, officers approach the patrol function in a team manner, i.e. there may be detectives on patrol and officers in undercover assignments, or there may be no marked police cars, or patrol is directed to specific areas only. Inherent in the team policing concept is autonomous responsibility of teams to the type and style of police services provided to the neighborhood.

Maximum interaction among team members, including internal communication among officers assigned to an area during a 24-hour period, seven days a week is another feature of team policing. The element of encouraging interaction among team members is an essential component to the strategy. Implicit in this concept of maximum

interaction is exchange of information. One of the techniques, within team policing, of accomplishing this exchange is through the scheduling of team conferences at regular intervals. The purpose of these meetings is to describe the difficult problems or incidents of the previous week and to discuss them with other officers, soliciting criticism and advice. This technique is based on the approach that continuing police problems cover more than one shift and one area and required cooperation among several police officers. Another critical factor in the communication process is the team leader. It is his responsibility to encourage the sharing of information and instill a sense of teamsmanship.

The third common element in team policing ventures is maximum communication among team members and the community. This is again facilitated by meetings, only this time between teams and the community. The purpose is to emphasize cooperative aspects of the peacekeeping function, open lines of information, and identify neighborhood problems. These conferences act as the vehicle for eliciting community involvement in the police function. Another technique is accomplished through auxiliary patrols, ride-along programs, and community voice in police policy making. Finally, maximum communication among teams and the community is enhanced by an efficient system of referral on non-police problems (e.g. emotional problems, abandoned cars, drug addiction, alcoholic rehabilitation) to appropriate service agencies. These participative programs are an important part in team policing as they are designed to bring the police and the community together in a spirit of cooperation.

Undoubtedly, team policing concepts address the ideals of police work. However, all too often, the ideals require a surplus of money, resources, and manpower. Each police department has a different history and different conditions of such resources as monetary funds, leadership, community support, integrity and initiative. The Jonesboro Police Department is no exception. Even though no complete and methodologically sound evaluation of team policing is currently available in the literature, there are at least three findings concerning team policing which have been noted.³¹ First, the community attitude toward it has proven to be outstanding, however, the patrol officer's belief is negative to it. Sherman captured the idea when he stated, "the community loves it and the patrolmen hate it."³² This is only natural, as community leaders and participants are allowed (for the first real time) to observe the police function and be part of it. The disadvantage is in police officer perceptions. For team policing to be successful, the officers involved must be cooperative and enthusiastic. If they observe the program to be a ruse for police administrators in appeasing community pressures (as observed in several incidents), then the ensuing cynical and non-productive attitude greatly detracts from the strategy. Second, the political arena of a city has much to do with the decision to implement team policing. It can be viewed as a "gamble," for many politicians, who wish to use the police as an instrument to show success or failure. And finally, team policing has exhibited the need for immediate access to quantities of specific resources (money, technical equipment, cars, and manpower) to be successful. Then too, the argument arises that if such resources were applied to traditional police methods, would not they also be as

successful? The dilemma remains; team policing takes resources. For small urban centers such as Jonesboro, a feasibility issue would be prime concern before the implementation of this patrol strategy.

Split-Force Patrol.³³ The Split-Force Patrol concept is a relatively recent development in the field of law enforcement and has been implemented in only a few police departments in the United States. The first agency to implement split-force patrol on a wide-scale basis was Wilmington, Delaware Police Department.

Split-Force Patrol is uniquely different from traditional patrol concepts in that it "splits" or "divides" the patrol force into two distinct and separate functions. Under the strategy, one part of the patrol force is assigned to respond to calls for service, investigate crimes, and perform other assigned apprehension duties. Another part of the patrol force is held in reserve for the express purpose of conducting preventative patrol, or as a deterrent agent. There are, of course, times when this distraction cannot be maintained and all units are required to respond to calls. The primary intent, however, is for one portion of the force to be devoted exclusively to prevention and deterrence techniques.

Charles D. Hale notes that the primary advantage of split-force patrol is that it allows more attention to be devoted to preventative patrol activities and that officers are assigned this function as a primary responsibility.³⁴ Under traditional patrol methods, preventative patrol is usually something that is done when time permits and after other obligations have been satisfied. Consequently, preventative patrol under normal patrol procedures does not always receive the attention it deserves.³⁵

Further, substantial evaluation of the split-force experiment in Wilmington reveals several interesting conclusions.³⁶ First, response time decreased as those assigned to apprehension patrol usually lingered in high-crime or high police demand areas. Second, arrest-related productivity increased. And finally, police professionalism, attitude, morale, and accountability increased.

At a single glance, split-force patrol appears to be a highly advantageous and desirable patrol strategy for any jurisdiction. However, a closer inspection reveals that split-patrol is, in essence, a combination of directed patrol activity and traditional patrol techniques. It requires, without a doubt, excessive amounts of manpower and resources. Further, from a theoretical standpoint, preventive patrol is derived from the concept that the omnipresence of the uniform officer prevents crime. Experiments in Kansas City and other observations conclude that this may not be correct.³⁷ The presence of uniform officers has a tendency to displace not prevent, crime. As C. Ray Jeffery concluded in his well-respected work on crime prevention, the factors of certainty in detection and arrest, swiftness of action, and sureness of punishment must be present for deterrence to be effective.³⁸

Split-Patrol Force appears to be a workable compromise between directed and preventive patrol. On one hand, the use of crime analysis is provided to detect patterns of crimes--their location, type, frequency, and timing--so that directed patrol can focus on such affected sites, thereby supporting the idea that most crime does not happen randomly. And on the other hand, random-moving, preventive patrol is assigned to increase police visibility in hopes to deter such

activity. The Split-Patrol Force assumes that some crime occurs randomly and some does not. It appears to be successful in those jurisdictions mentioned and may provide a feasible strategy for small cities like Jonesboro, Arkansas.

Tactical Patrol. The final patrol strategy to be discussed is actually a conglomerate of three techniques, either used singularly or in conjunction with one another. The procedures all utilize a small sample of the overall police patrol force to provide a special patrol unit. This patrol factor can either be a permanent assignment where those chosen in the Tactical Patrol Force remain for extended periods of time or they may be rotational by month, week, day, or even shift. Where small cities are involved or where the number of sectors is limited, it is more advantageous to have rotational assignments. However, this will be discussed later. The three techniques are embodied in flexible shift patrol, fluid overlay patrol, and "wild" car patrol.

Flexible Shift Patrol. This aspect of the tactical patrol procedure allows for a group or unit of officers to be assigned to an "overlay" shift. In other words, if the normal assignment hours are 7:00 a.m. to 3:00 p.m. to 11:00 p.m., then the flexible shift patrol force may be assigned to a 6:00 p.m. to 2:00 a.m. shift. The goal being to maximize the number of officers in a patrol capacity during the hours of peak demand. In most instances, the flexible shift patrol is also a fluid overlay.

Fluid Overlay Patrol. The fluid overlay patrol technique was first explored in Tucson, Arizona in the late 1960's.³⁹ It provides for a patrol force to act not only as a shift overlay, but also as a

sector overlay. The fluid overlay patrol procedure allows for manpower to support the regular patrol sectors. Officers in the fluid overlay units are assigned in relative proportion to anticipated needs in a specific geographical area.

Ideally, this unit would act in conjunction with the major body of patrol force personnel to perform enforcement and apprehension activities. In a recent evaluation of this technique, overall response to calls and response time to high priority calls were greatly improved over traditional patrol methods.⁴⁰ The fundamental technique employed here, is again a combination of directed patrol and split patrol theory; the difference being only a fraction of the patrol force is involved (one or two units). The tactical unit often being referred to as a "wild" car, "trouble" car, "hot" car, or "felony" car.

"Wild" Car Patrol. The theoretical implications involved here are based on the directed patrol concept--crime does not happen randomly. The "wild" car is a shift and sector overlay unit which does not respond to routine calls of a non-criminal nature. It is held in reserve, assigned to the high-crime and high-demand areas and times. The "wild" car is primarily responsible for support of sector officers. This means that the "wild" car responds to all major crimes in progress and other emergencies. The "wild" car is utilized to maximize officer presence at a scene quickly, for this reason the unit is always two-man.

In actuality, the "wild" car performs three functions. First, it is primarily a major enforcement unit responding to all "hot" calls. Because it is two-man, it maximizes officer presence in a mobile state. Second, the "wild" car is assigned to high-crime areas and is a

marked patrol unit. It serves in a preventative or deterrence capacity when not deployed. Lastly, the "wild" car acts as relief and support to sector officers. This enables officers to take the extra time to do a good report, or a thorough investigation, or to take a dinner break on a busy night, without the annoying thought that a sector is empty and back-up is a long distance away. With a "wild" car, there should always be a centrally located unit for emergency response, except in those extremely busy nights.

The Tactical Patrol Force offers several benefits along with increased response time. First, the procedures allow a squad sergeant to rotate and change the patrol assignments within a geographical area--thus allowing an individual to become thoroughly familiar with the entire precinct or jurisdiction. This also allows an evening of workload among officers over a long span of time as no one is permanently assigned a high demand sector. Second, the two-man "wild" car technique allows for a natural "training" ground. A rookie can be "broken in" and experience the job with the knowledge of a veteran at his side. This maximizes manpower use. Third, the "wild" car can be utilized for special assignments or details without affecting the rest of the shift. If a stake-out is needed, or special crowd control, the "wild" car is always available. What must be emphasized is that the "wild" car is a complement to the traditional, fixed sector patrol design. Fourth, this procedure reduces calls for back-up as two officers are present in the same car, responding to "hot" calls. This interprets into direct savings in vehicle maintenance and gas consumption as units are no longer required to travel long distances in support of one another. Fifth, the two man car provides officer safety

benefits; not only within the "wild" car, but also to that unit requesting back-up. Some agencies attempt to pair a sergeant with an officer in the "wild" car in an attempt to always have a supervisor immediately at the scene of a major incident. An excellent side benefit to this technique, is the ability to directly supervise and motivate those officers who do not produce alone or in one-man cars. Additionally, by rotating monthly, morale is kept high by each officer working the "wild" car and informally getting to know the sergeant in a direct working situation. Sixth, the "wild" car is a shift overlay which allows for at least some patrol coverage in the community during shift change. This is especially important during the afternoon-night shift periods of 10:00 p.m. to 1:00 a.m. as this is usually the time of peak demand and priority calls. As exhibited in Jonesboro, the 11:00 p.m. shift change hour is the single highest hour for police call frequency and workload. And finally, the tactical patrol procedures allow manpower to be distributed through the total participation of an organization. By coordinating detective and uniform information, the "wild" car is dispersed to areas of "most need." If one officer is sick or on vacation, a lieutenant or even a captain can function as the second man in the "wild" car. This not only refreshes command with the "street" experiences of police work, it also bridges the communication gap between officer and management personnel.

Summary of Findings

Based on the multiple response indices of geographical locations within the City of Jonesboro, Arkansas, the following relationships were discovered.

First, the need for twenty-four hour police protection required the establishment of an assignment-availability factor in determining patrol strength. For the Jonesboro Police Department to man one sector seven days a week, 365 days a year computed to a 1.85 factor based on the unique circumstances of number of days off, number of vacation days, number of days training, etc., due to loss of officer time. Practically speaking, this interpreted into a need of six officers per sector for a twenty-four hour time period; or a total of 30 officers available for patrol activity to provide services to the Jonesboro community.

In order to determine shift hours, the number of calls by month and day was studied. There appeared to be little variance between months as the standard deviation of calls by month was low. However, in comparison, there was extreme deviation between days of the week. A plot of multiple response indices by day graphically revealed that Friday and Saturday required more police manpower needs as their respective workload nearly doubled that of any other day.

In selecting shift hours, an extremely low chi square and high variance supported the conclusion that the variables of calls for service and shift rotation were independent. Further observation revealed that the peak hours of police activity occurred between the hours of 9:00 p.m. and 12:00 midnight. A plot of within-shift variance by shift rotation schemes displayed that the current assignments of 7:00 a.m. to 3:00 p.m. to 11:00 p.m. were most beneficial for people-oriented production such as exhibited in the Jonesboro Police Department.

Further, a new sector design was compared to current sector design by use of the Kruskal-Wallis Analysis of Variance by Ranks in order to show equalization of workload between patrol districts. The current design was found to have an H value of 15.64 which exceeded the 7.82 rejection region at an alpha of .05. However, the proposed design calculated to an H value of 3.94 at the same rejection level. While significance at 15.64 rejected the null hypothesis, the proposed design supported the concept that the medians of the multiple response index populations were equal; or that the MRI workload was more evenly balanced between sectors. In additional support to this finding, mean response time for the new sector design was found to be 20 seconds lower, indicating an increase in police officer safety and a decrease in gas resource expenditures.

Finally, several patrol strategies and techniques were explored--fixed sector patrol, magnetic beat patrol, directed patrol, team policing, split-force patrol, and tactical patrol. All have an advantage under circumstances, and none can be said to be the "best" approach all the time. The police administrator must manage and select a strategy which uniquely fits his conditions. He must have a keenly developed sense of cost effectiveness as there will be a finite amount of resources allocated to his task. He must follow a calculated and systematic method for decision-making that will result in the fulfillment of the department's needs. And most important, the police administrator must be adaptable and flexible in selecting an urban patrol strategy. Policing requires a complex mix of forces to attack the myriad of problems facing a community. The demands for quick police response, suppressed criminal activity, and political

expenditure justification require the development of a force-in-combination that engages a number of distinct police elements in a coordinated, cooperative, and consistent manner.⁴¹

These findings, considered together, support the conclusion that the new, proposed sector design matched with a tactical patrol strategy would improve officer efficiency (by equalizing workload) in the City of Jonesboro, Arkansas. Appendix A offers a list of recommendations for Jonesboro as well as an optimum design plan.

NOTES

¹ Gary W. Cordner, "Police Patrol Workload Studies: A Review and Critique," International Review of Police Development 2, (Summer 1979), p. 52.

² Magorah Maruyama, "Human Futuristics and Urban Planning," AIP Journal, (September 1973), p. 18.

³ John N. Driscoll, "Anticipatory Management: Coping with Rapid Environmental Change," Organizational Dynamics 16, (March 1979), p. 12.

⁴ Herman Goldstein, Policing a Free Society (Cambridge: Ballinger Publishing Company, 1977), p. 52.

⁵ For a detailed discussion of patrol strategies refer to National Commission on Productivity. Opportunities for Improving Productivity in Police Services (Washington, D.C.: Government Printing Office, 1973); George J. Sullivan, Directed Patrol (Kansas City: Kansas City Police Department, 1976); J. F. Elliot, Interception Patrol (Springfield: Charles C. Thomas, 1973); William G. Gay, et al, Prescriptive Package: Improving Patrol Productivity, Volume I and II (Washington, D.C.: Government Printing Office, 1978); Joseph H. Lewis, "Evaluation of Experiments in Policing: What Are We Learning?" Evaluation Quarterly 2, (May 1978); William Gay, et al, National Evaluation Program in Team Policing (Washington, D.C.: Government Printing Office, 1976). Further, the concept of effectiveness as a product of

officer attitude and officer motivation is explored as a form of patrol by James W. Wilson and Barbara Boland, "The Effect of Police on Crime," Law and Society 12, (Spring 1978).

⁶ Walter F. Kreutzer, "A Simplified Method of Patrol Distribution," Police Chief 7, (July 1969), p. 41.

⁷ A causal relationship between unemployment, social class, poverty and crime have been explored by Matthew Yeager, "Unemployment and Imprisonment," Journal of Criminal Law and Criminology 70, (Winter 1979); Basil Wilson, et al, "Ghetto Reflections and the Role of the Police," Journal of Police Science and Administration 7, (March 1979); David F. Greenberg, "Dynamics of Oscillatory Punishment Processes," Journal of Criminal Law and Criminology 68, (December 1977); Tarold O. Kvalseth, "The Effects of Population Density and Unemployment on Urban Crime," Criminology: An Interdisciplinary Journal 15, (May 1977); and Richard A. Johnson, "Social Class and Criminal Behavior," Criminology 18, May 1980. Further, these articles make references to many sociological theorists who have addressed these causal linkages, such as Edwin Sutherland, Donald Cressey, Robert Merton, Albert Cohen, Richard Cloward, Walter Miller, and Richard Quinney.

⁸ U.S. Bureau of Census, Social and Economic Characteristics of the Metropolitan and Non-Metropolitan Population (Washington, D.C.: Government Printing Office, 1977), p. 2.

⁹ U.S. Bureau of Census, Statistical Abstracts (Washington, D.C.: Government Printing Office, 1979), p. 31.

¹⁰ City of Jonesboro, Arkansas, Budget Report (1979), p. 10.

¹¹ City of Jonesboro, Arkansas, Budget Report (1979), p. 10. A comparison of salaries in similar cities in Arkansas is presented in Appendix A.

¹² Donald T. Shanahan, Patrol Administration: Management by Objectives (Boston: Allyn and Bacon Publishing, 1978), p. 375. Dr. Shanahan presents a rather simplified calculation of assignment-availability factor in his book. Several of his steps have been utilized in this dissertation procedure.

¹³ Calculated manpower based on proposed increase of five officers.

¹⁴ FBI Uniform Crime Reports (Washington, D.C.: U.S. Government Printing Office, 1979), pp. 5-37.

¹⁵ FBI Uniform Crime Reports, p. 5-37.

¹⁶ Shanahan, P. 375.

¹⁷ FBI Uniform Crime Reports, p. 5-37.

¹⁸ Shanahan, p. 375.

¹⁹ Warren G. Bennis, "Theory and Method in Applying Behavioral Science to Planned Organizational Change," The Journal of Applied Behavioral Science, I, No. 4 (1965), p. 339.

²⁰ The approved procedure for hypothesis testing in the behavioral science is thoroughly discussed in Sidney Siegel, Nonparametric Statistics for the Behavioral Sciences (New York: McGraw-Hill Book Company, 1956), pp. 6-18. These steps are universally accepted as an objective scientific method: (1) state the null hypothesis, (2) choose the statistical for testing the null hypothesis, including its associated statistical model, (3) specify a significance

level (α) and a sample size (N), (4) state the sampling distribution of the statistical test under the null hypothesis, (5) define the region of rejection, (6) compute the value of the statistical test, using the data obtained from the sample, and (7) decide whether to reject the null hypothesis if the value is in the rejection region or accept the null hypothesis if the value is outside the region of rejection.

²¹ W. H. Kruskal and W. A. Wallis, "Use of Ranks in One-Criterion Variance Analysis," Journal of American Statistics Association 47 (1952), p. 603.

²² Siegel, P. 249.

²³ Siegel, p. 249.

²⁴ Jerry L. Carlin and Colin L. Moodie, "A Comparison of Some Patrol Methods," Police, (August 1972), p. 56.

²⁵ Donald T. Shanahan, Patrol Administration: Management by Objectives (Boston: Allyn and Bacon, Inc., 1979), p. 391.

²⁶ Jerry L. Carlin and Colin L. Moodie, p. 62.

²⁷ Ernst Nilsson, "Patrol Manpower Allocation," Operations Task Force Report (Chicago: Chicago Police Department, 1968), p. 27.

²⁸ George J. Sullivan, Directed Patrol (Kansas City: Kansas City Police Department, 1976).

²⁹ G. Douglas Gourley and Allen P. Bristow, Patrol Administration (Springfield: Thomas C. Publishing, 1961), p. 94.

³⁰ William Gay, et al, National Evaluation in Team Policing (Washington, D.C.: Government Printing Office, 1976); Joseph H. Lewis, "Evaluation of Experiments in Policing: What Are We Learning?" Evaluation Quarterly 2, (May 1978); and Lawrence W. Sherman, et al,

Team Policing (Washington, D.C.: Police Foundation, 1973). The concept of team policing is thoroughly discussed in this classic book. Analyzing seven cities from a case approach, the authors indicate strengths and weaknesses of the patrol strategy. Parts of this dissertation section are summarized from this work.

³¹ Discussions regarding the evaluation of team policing are very limited. To date, the most thorough analysis can be found in Jack L. Kuykendahl and Peter C. Unsinger, Community Police Administration (Chicago: Nelson-Hall Publishing Company, 1978).

³² Sherman, p. 102.

³³ Split-Force Patrol is adequately discussed in Charles D. Hale, Police Patrol Operations and Management (New York: John Wiley and Sons, 1981), p. 121-124. However, a thorough evaluation of the patrol concept was conducted in Wilmington, Delaware. See James M. Tien, et al, An Evaluation Report of an Alternative Approach in Police Patrol: the Wilmington Split-Force Experiment (Cambridge: Public Systems Evaluation, Inc., 1977).

³⁴ Hale, p. 122.

³⁵ Hale, p. 122.

³⁶ Tien, p. 7.

³⁷ George E. Kelling, et al, The Kansas city Preventative Patrol Experiment: A Summary Report (Washington, D.C.: Police Foundation, 1974).

³⁸ C. Ray Jefferey, Crime Prevention Through Environmental Design (Beverly Hills: Sage Publications, 1971).

³⁹ Frank A. Zunno, "A Changing Concept," Police Chief, XXXVI, (June 1969), p. 62.

⁴⁰ Carlin and Moodie, p. 61.

⁴¹ Anthony V. Bouza, Police Administration, Organization and Performance (New York: Pergamon Press, 1981), p. 9.

CHAPTER V

DISCUSSION AND SUMMARY

The method designed in this study is an approach to combining decision-making elements regarding the deployment of police patrol manpower. The City of Jonesboro, Arkansas was used as a subject to demonstrate this model.

An objective of social science research is to generalize findings or stimulate research in other populations, other places, and other times than those sampled for study itself. . . so it is with this dissertation. The method presented herein is a process that can be utilized in similar cities with similar problems. The logical inferences drawn from this deployment method suggest an approach which is highly useful and marketable in today's conditions. Small urban centers are provided a method for achieving an optimum deployment plan based on the total participation of the police department, considering the political, economic, cultural, and social environment of that unique community.

However, this treatise explores a much broader set of theoretical perspectives than those initiated by patrol deployment. The development of a new decision-making model (Integrated Management Decision-Making) exposes the need for major changes in police management thinking.

First, the relationship between the "learning" approach to decision-making and the management of police organizations must be

fully addressed. Police managers must be aware that their organizations are drastically influenced by a circular and dynamic relationship between the organization and the environment. Further, police managers must assume that information exchange within this relationship is directly correlated to a continuous, evolving, and prescriptive input for exploring alternative future for decision-making. This tenuous relationship between organization and environment can be viewed as an educational strategy to cope with change. Organizations learn to become capable of transformation and adaptation by restructuring to fit the environment. In essence, this is the decision-making process--learning to integrate organization with environment and vice-versa.

Second, administrators must consider the police organization from a total systems concept. It is both a system with vital components and parts as well as a subsystem of a much greater environment. The way in which the organization integrates with the other segments of this environment determine the accomplishment and effectiveness of specific objectives. For this reason, political, economic, cultural, racial, legal, and industrial influences must be considered during internal policy changes which alter the police function. Traditionally, police managers have not fully understood nor considered the police role as an integral part of the environment. For example, in Jonesboro, the redesign of patrol deployment in that city produced a wide variety of consequences. The documented need for more police officers placed an economic burden on the city government, which in turn, stimulated a political argument concerning overexpenditure, all of which was fully addressed by the local media which heightened public interest. Appendix B refers to this situation.

Indeed, the need for police administrators to address environmental concerns is a primary focus of Integrated Management Decision-making. Also, managers must change their concept of describing the police world. C. West Churchman explains that a major fault exhibited in current problem-solving approaches is the failure to think in terms of function and purpose.¹ In like manner, police managers fail to address the overall purpose of the police organization. Instead, they continually re-describe the police structure by dwelling on the physical world of crime rates, new police cars, civil service tests, etc. The natural result is a stifling of creativity, innovation, and futuristic thinking. Indeed, the police structure described today may not be the same entity that will exist in tomorrow's world.

Further, more emphasis must be placed on the awareness of turbulence and change in the environment. This dissertation has described a very complex, dynamic, and intricate relationship between the environment and the police organization. There exists an important and critical demand to monitor and update these changes within the environment so that strategies can be planned to deal with future uncertainties and contingencies which drastically effect the police organization. For this reason, this study suggests the adoption of a separate and distinct police unit to assist management. Such a unit should be internal and; responsible for the monitoring and updating of social, cultural, economic, political, legal, industrial and any other environmental factor which may influence the police function. These units could be called "Environmental Analysis Units" and would provide a necessary input for the decision-making process. From such units, data for brainstorming adventures, knowledge surveys,

Delphi techniques, modeling and scenarios, strategic planning, and other tools which stimulate imaginative thinking could be possible.

Of course, this would necessitate a police manager that is capable of an interdisciplinary approach; one that could understand the basic concepts of human and social interaction, one that is cognizant of environmental influences, one that has the capacity for conceptualization, abstract thinking, and one that can consider problems in terms of probabilities. The police manager must be an "expert" at listening to what others have to say and must have the ability to "cut through" not "muddle through" an environment where private interests abound. He must have the ability to tolerate ambiguity and confusion. He must have a propensity to innovate and create new alternatives to old problems. He must be able to "feel" what is possible and to some extent attempt to tell the future. Such a concept for new variation in the police management field can only occur through re-training of existing police administrators. In-service training schools and management workshops are suggested to fulfill this task. Additionally, new police managers should possess a wide range of academic and work experience. The traditional concept of the police chief with only 30 years experience within the police ranks should be abandoned, as such personnel often perpetuate stagnation and mediocrity.

These are not novel and radical ideas. The business world has addressed these concepts for the last decade. What is new is the application of such prescriptive thoughts to police organizations. Indeed, to set forth long-range planning objectives, to develop new concepts to deal with new problems and contingencies as well as

formulate new steps and new procedures to deal with current situations, will require the police organization to integrate with the environment.

Suggestions for Further Research

One of the areas of exploration regarding this dissertation is the testing of the model presented. A prepost experimental test should be established as an integral part of the evaluation step incorporated in the method. In this manner, a refinement of the decision-making process can be conducted. Thus, improvements may be suggested, or specific aspects modified if indicated by test results, and implemented.

Second, the relationship between police preventive patrol activity and crime prevention, deterrence, and on-scene criminal apprehension must be more thoroughly examined and tested. The forms of patrol must be assessed in relation to the allocation design and crime analysis technique available to a police department.

Third, further research in the area of predicting crime and volume of calls for service must be investigated so that police can be recruited and deployed based on more accurate knowledge of the need for police service in each geographic area and time period.

And finally, the relationship between the decision-making process and the deployment of police patrol manpower must be a continual focus of further inquiry. By identifying and defining those key elements in the managerial process of decision-making, a more accurate set of objectives and goals for the police patrol function may be attained; thereby improving the overall performance of the police. As Magorah

Maruyama so eloquently stated, research should be "catalytic."² It is the purpose of this dissertation, and the goal of Integrated Management Decision-Making, to encourage the individual to develop new types of reality-testing and problem-solving techniques. Such an objective, highlights the research purpose and hopefully generates new thought, innovation and creativity, so desperately needed in the police arena.

NOTES

¹ C. West Churchman, The System Approach (New York: Dell Publishing Company, 1979), p. 13.

² Magorah Maruyama, "Human Futuristic and Urban Planning," AIP Journal, (September 1973), p. 346.

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APPENDIX A

MANPOWER ALLOCATION - RECORDS SYSTEMS STUDY

Jonesboro Police Department

Jonesboro, Arkansas

Abstracts and Recommendations of Study

PROPOSAL ABSTRACT TO THE JONESBORO CITY COUNCIL

January 19, 1981

The police officer role cannot be defined. Traditional concepts of what a police officer should do and the qualities needed to attain police officer status have obviously not met conventional standards. However, the function of a police bureau has been set forth not only in written policy but also within the minds of every citizen--to efficiently offer service to the community, to protect the lives and property of others, and to do so at the minimum of monetary expenses on a cost-efficiency basis.

So it is with the Jonesboro Police Department. The challenge is to obtain maximum efficiency and effectiveness in deploying police manpower resources within a limited budget. To accomplish this, an analysis of statistical data is necessary.

It will be the purpose of this study to collect and analyze a data base by which police manpower deployment can be distributed. This will involve coding of every radio-dispatched police "call" for the year of 1980 in Jonesboro, Arkansas; and the computer-assisted analysis of these police responses.

The following manpower criteria will be the discussion of analysis and subsequent goals for this study:

1. Prediction of rates of calls for service.
2. Determination of actual manpower (patrol units) needed per shift.

3. Design of patrol sectors based on equalization of workload, priority calls, and geographical considerations.
4. Design of a dispatch strategy based on statistical data presented.
5. Design of a police dispatch radio log.
6. Systemization and unification of police records and reports.

RECOMMENDATIONS - JONESBORO CITY COUNCIL

May 4, 1981 - 7:30 p.m.

The following recommendations are based on an exhaustive research project conducted at the Jonesboro Police Department entitled, "Police Patrol Deployment in Urban Centers Under 100,000: A Method for Decision-making." They are the product of long hours of study and application of crime data to existing patrol conditions in Jonesboro, Arkansas.

Manpower Strength. The City of Jonesboro is the agricultural center for northeast Arkansas. It reflects a standard population figure of 32,000; however, on any given day the population booms to well over 50,000 people stemming from local trade in the surrounding rural area.

The Federal Bureau of Investigation and the International Association of Chiefs of Police have calculated necessary ratios for cities having populations between 20,000 and 49,000. The FBI revealed in the 1980 Uniform Crime Report that a police officer ratio of 1.9 per thousand population should be employed in small urban centers, while IACP initiated a 1 officer per 500 population statistic. Although these figures are based on national trends and Jonesboro, Arkansas does exhibit a certain degree of uniqueness, these ratios propose that Jonesboro (a city of 32,000) should support approximately 64 sworn police officers.

The current manpower force of the Jonesboro Police Department is 44 sworn personnel. Statistically, it is impossible for the Jonesboro Police Department to provide efficient and effective police services to the community under existing patrol and manpower conditions. For this reason, it is strongly recommended that funding for ten new officers and three new civilian dispatchers be allocated immediately, thereby raising the sworn manpower strength of the Jonesboro Police Department to 54.

Police Services. Realizing the service needs of Jonesboro, the police department has traditionally accepted certain tasks and functions which local merchants have enjoyed. Some of these services are the escorting of funeral processions, the custodial security provided banks and other merchants during deposit times, and the extra security provided certain entertainment and sports activities in the area. However, with the increase in city size, population, density, and demand for police presence, these services will not be as readily available as in the past. All future police services will be prioritized as to the urgency and necessity of each demand. Lower priority services will be accomplished when manpower and resources are available.

False Alarms. During the year 1980, the Jonesboro, Arkansas Police Department responded to over 875 false alarms. On each occasion, at least two officers were sent to the location and an average officer time expenditure was calculated at 21 minutes per officer per alarm. Thus, for each false alarm, the police department allocated approximately 40 minutes and two officers.

A blaring statistic regarding false alarms revealed that the majority were the result of a handful of private businesses failing to fix or improve alarm efficiency. One business had over 200 false alarms in the year. For this reason, a false alarm fine (in the form of a city ordinance) is strongly recommended. Many cities have adopted such a provision. An example of an alarm fine would be the assessment of \$50.00 against the business for each police response after the third false alarm per month.

Salary Administration. Salary administration in any organization is always a most delicate issue. Certainly everyone would like more money. On the other hand, the interest of the tax payers must be considered, and equity with other city departments is necessary. This study revealed two observations which are directly relevant.

First, referring to the attached table, it is quite obvious that patrol officers in the Jonesboro Police Department are substantially underpaid. Comparing the salaries of Jonesboro police officers to similar jurisdictions, an expansive disparity exists. A proposed recommendation of 15 percent increase in officer salary would close this disparity; and equal the Arkansas State Police Salary Average for cities between 20,000 and 40,000 population.

The second observation regarding salary structure pertains to the differentials between ranks in the agency. It is quite apparent that an insufficient differential exists in this regard. This situation is attributable to the city's use of a negative step salary scale, e.g. a patrol officer upon promotion to Sergeant "steps back" to that salary level in the Sergeant's classification which is minimum amount above

his current salary. Thus, a promotion often means only a nominal increase in salary. Salary differential between ranks is generally substantial in law enforcement agencies. For this reason, a 12 to 15 percent step differential is strongly recommended.

TABLE XIII
CITY POLICE EXPENDITURES AND SALARIES
IN ARKANSAS, 1981

(For cities with populations from 20,000 - 40,000)

<u>CITY</u>	<u>POPULATION</u>	<u>TOTAL CITY BUDGET</u>	<u>TOTAL POLICE BUDGET</u>	<u>% of BUDGET TO POLICE</u>	<u>POLICE SALARIES</u>
Springdale	21,200	\$ 2,647,456	\$ 820,601	31%	\$ 12,876
Blytheville	24,600	3,293,128	791,921	24%	11,414
El Dorado	24,900	2,284,582	719,450	31%	12,276
West Memphis	25,000	5,038,500	1,233,950	24%	14,928
Jacksonville	26,500	3,013,251	867,879	29%	12,780
Fayetteville	34,900	5,065,761	1,002,017	20%	11,880
Hot Springs	40,000	7,455,000	1,475,422	<u>20%</u>	<u>12,706</u>
			AVERAGE:	25.5%	\$ 12,690
JONESBORO	32,900	5,494,623	952,184	17%	11,052

I.A.C.P. National Average for Police Salaries for
Cities under 40,000 Population \$ 14,500
Arkansas State Average (from above) \$ 12,690
Proposed 15% Salary Increase \$ 12,700

RECOMMENDATIONS - JONESBORO POLICE DEPARTMENT

May 12, 1981

The following recommendations are given to Chief Edward Cunningham, Jonesboro Police Department based on the research project entitled, "Police Patrol Deployment in Urban Centers Under 100,000: A Method for Decision-making."

Patrol Division

1. Initiate a short 5-10 minute roll call and meeting before each shift to disseminate information.
2. Require officers to carry and use personal notebooks.
3. Distribute a list of local stolen cars ("hot" sheet) every week.
4. Eliminate funeral escorts.
5. Man every patrol district or sector before assigning personnel to selective enforcement. Never utilize more than two persons as accident investigators per shift.
6. Require officers to clear from a call before writing reports. Stop accident investigators from typing reports and making scale diagrams of minor accidents.
7. Attempt to supply each man with a portable radio.
8. Buy locking shotgun mounts for police cars.
9. Standardize police weapon and ammunition.
10. Continue training officers in survival and patrol techniques.

Radio-Dispatch Division

1. Attempt to minimize officers doing the dispatch function; utilize civilians in this capacity.
2. Formulate policy for dispatch procedures.
3. Send automatic back-up or cover to "hot" calls and emergency situations.
4. Attempt to minimize the dispatching of cars outside their respective districts or sectors for cold calls.
5. Never allow more than two officers on break at the same time.
6. Eliminate current dispatch log and reports. Initiate the use of recommended log and roll call meetings.
7. Send patrol cars to felony calls first. Allow the officer to assess the situation and then ask for detective if needed.
8. Block-off dispatch area by covering front windows with a curtain.
9. Attempt to minimize access to dispatch control by locking side doors.
10. If personnel is available, man dispatch control with two people.

Records Division

1. Standardize all reports.
2. Eliminate the current incident report and establish one CRIME REPORT to be used for every call involving a crime, no matter how trivial.
3. Utilize a 3" x 5" card crosstabulation file by name, date of birth, address, incident type, and case number.

4. Initiate sequential case numbers by year; use first two digits for the year.
5. Initiate the use of military time on all reports.
6. Keep all original reports in Records Division. Copies may be disseminated to other divisions.
7. Minimize access to Records Division.
8. Route all reports to Records Division for dissemination.
9. Maintain a master report log.
10. Formulate policy for Records Division Operations.

THE JONESBORO POLICE DEPARTMENT

FINAL RECOMMENDATIONS

May 15, 1981

The strength of any study lies within the parameters of its data, so it is with this report. Based on the 1980 statistical information derived from police reports and radio-dispatch logs; and by the employment of the previously setforth method of decision-making, the following recommendations can be enumerated:

1. During council with police administrators, the variables of incident type, weight factor of call, seriousness of arrest, and need for emergency back-up were selected as prioritized criteria within the method. Therefore, any procedure to be implemented should consider these standards.
2. The following allocation design can be statistically supported based on the subjective criteria used in the method:

RECOMMENDED ALLOCATION DESIGN
JONESBORO POLICE DEPARTMENT

Assignment-Availability Factor: 1.85

Actual patrol officers required: 30

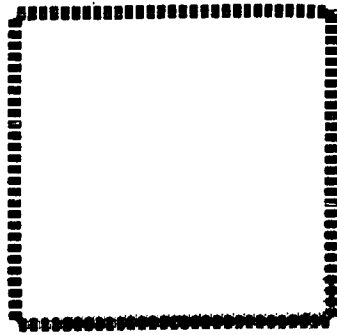
Shift and Manpower Determination

7 officers - Morning Shift	7:00 a.m. - 3:00 p.m.
7 officers - Afternoon Shift	3:00 p.m. - 11:00 p.m.
7 officers - Night Shift	11:00 p.m. - 7:00 a.m.
3 officers - Tactical Shift	6:00 p.m. - 2:00 a.m.
6 officers - Selective Traffic Enforcement	

Two officers per shift, excluding Tactical Patrol

3. Figure 8 is a redesign of sector boundaries predicated on equalized workload (Kruskal-Wallis Test) and selected criteria. A tactical patrol, "wild" car overlay is utilized in the high-crime and high-demand location. It is important to note that the overlay unit covers not only the area of highest demand but also the times of highest demand. Further, the City of Jonesboro represents a natural fit to this strategy as the high-demand location is centrally located, enabling maximum use of the two-men "wild" car technique.
4. All methods of patrol allocation and distribution emphasize the fundamental need for accurate reporting of crime so data collected can be used to reveal information of past conditions as well as predict future conditions on which the

allocation and distribution of manpower can be based. For this reason, an evaluation of records and radio-dispatch log procedures should accompany the quarterly examination of deployment needs.



**TWO-MAN TACTICAL PATROL:
WILD CAR OVERLAY
Shift Hours: 6:00 pm--2:00 am**

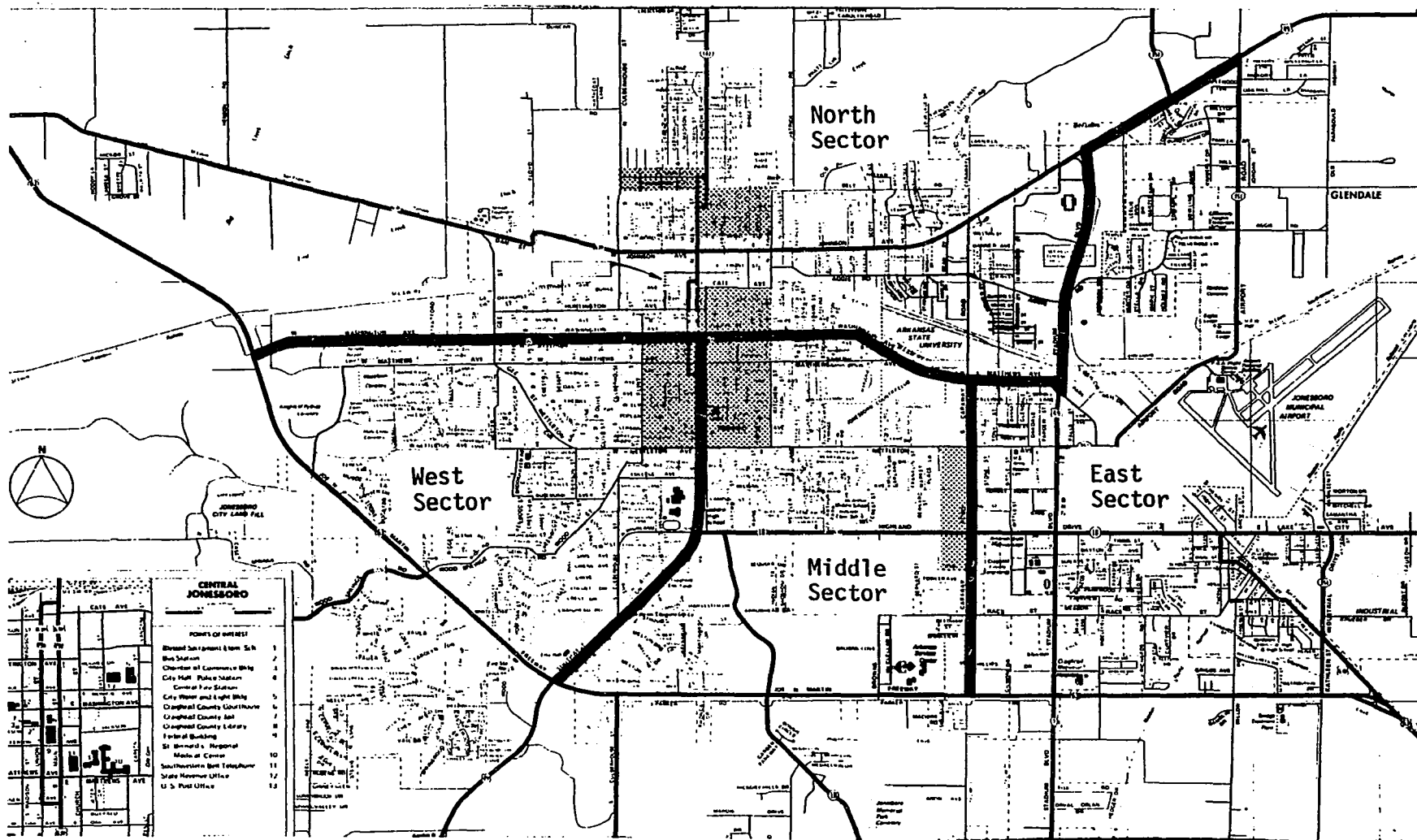


Figure 8: Recommended Sector Design with Tactical Patrol, "Wild" Car Overlay. Shaded areas represent high multiple response index locations.

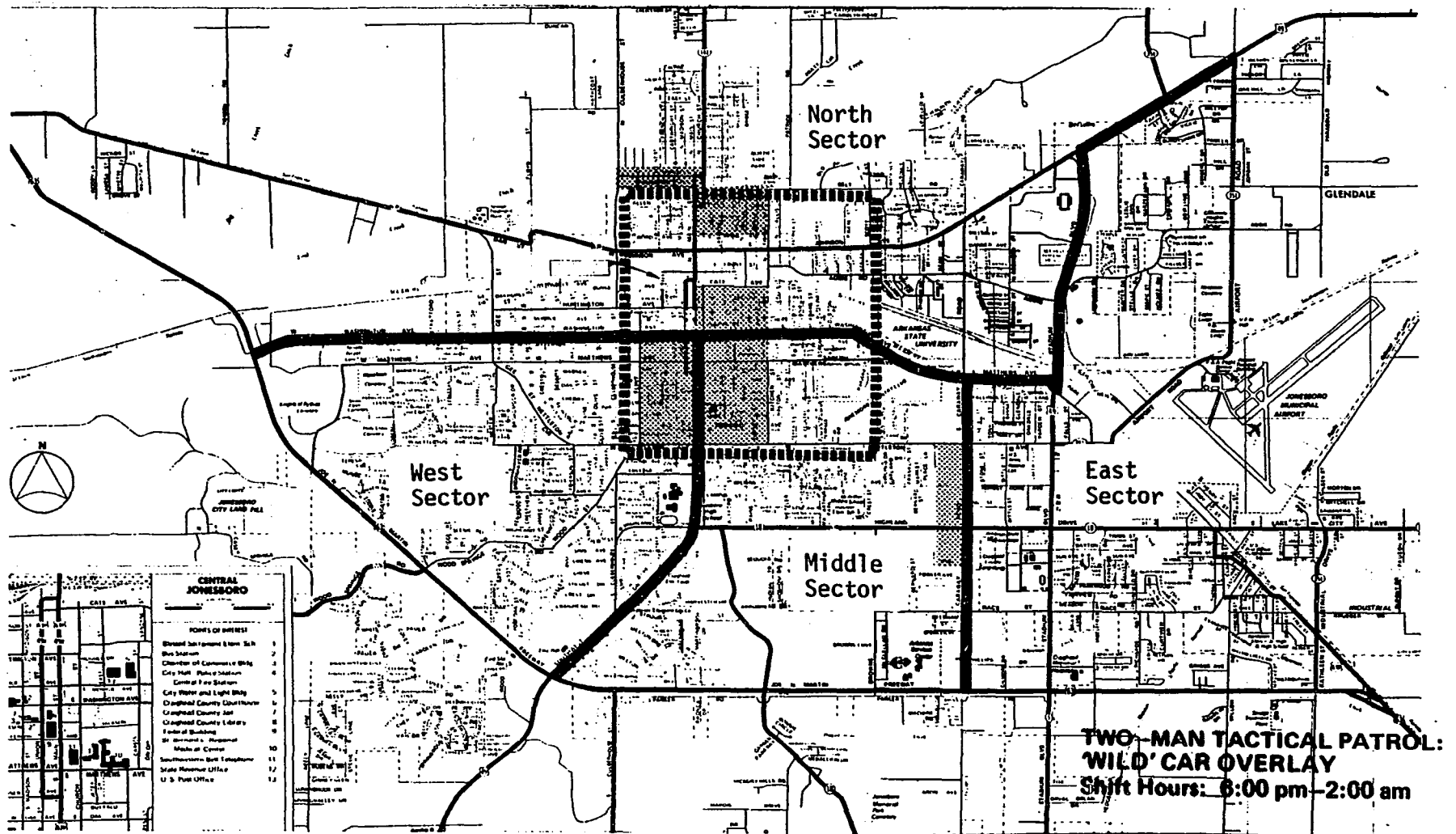


Figure 8: Recommended Sector Design with Tactical Patrol, "Wild" Car Overlay. Shaded areas represent high multiple response index locations.

APPENDIX B

MEDIA COVERAGE - JONESBORO, ARKANSAS

The Jonesboro Sun.

Friday, January 23, 1981.

SPORTS COMICS CLASSIFIEDS

11.

Jonesboro Police—

Department Efficiency Studied

In these days of rising prices and limited budgets, many governmental agencies — on the national, state and local level — are studying ways to tighten their belts in order to operate efficiently.

The Jonesboro Police Department is no exception to the rule.

Robert W. Taylor, criminology instructor at Arkansas State University, will be donating his time and effort to a study aimed at maximizing efficiency and effectiveness in deploying police manpower resources with a limited budget. Taylor explained during a press conference at the Justice Complex Thursday morning that he will conduct an analysis of statistical data.

He added that information gathered from the study will be used to design Jonesboro as a model city of under 100,000 population in efficient police manpower. He also said a model city program will attract nation-

al attention through articles he hopes to have published in various journals and other such publications.

Taylor, who has a masters degree in criminology, explained the purpose of the study is to collect and analyze a data base by which police manpower deployment can be distributed. This will involve coding of every radio dispatched police "call" for the year of 1980 in Jonesboro and the computer-assisted analysis of these police responses.

"With the price of gas and salaries these days, it is important for police departments to make the best use of police officers," Taylor said. He added the study will question whether Jonesboro has enough police officers to patrol the city adequately.

Taylor said the study will be completed in written form with-

in six months. Taylor lists objectives of the study as:

- The ability to predict rates of calls for service.
- Determination of actual manpower (patrol units) needed per shift.
- Design of patrol sectors based on equalization of workload, priority calls, and geographical consideration.
- Design of a dispatch strategy based on statistical data presented.
- Design of a police dispatch radio log.
- Standardization of police records and reports.

Taylor said he hopes the study will make Jonesboro a model city for other such cities under 100,000 population to follow. Such a program, Taylor added, will allow cities to operate more efficiently on limited budgets, while at the same time offer a greater police protection.

Figure 9: The Jonesboro Sun, 77:36, Section B, page 1, January 23, 1981.

The Jonesboro Sun.

SEVENTY SEVENTH YEAR - No. 151. Associated Press
Leased Wire

JONESBORO, ARKANSAS 72401.

TUESDAY, MAY 5, 1981.

32 PAGES.

PRICE 15 CENTS.

Study Indicates—

Police Manpower, Salaries Too Low

By LARRY FUGATE

An extensive study of the Jonesboro Police Department indicates the department is seriously undermanned and police salaries are the lowest for any Arkansas city in the 20,000 to 40,000 population range. City Council members were told Monday evening.

Robert W. Taylor, instructor in and coordinator for law enforcement studies at Arkansas State University, told aldermen Jonesboro police officers need a 15 per cent across the board salary hike just to reach a state-wide average of police salaries paid by municipalities in the population range.

Taylor said the study indicates manpower shortages could pose major problems, noting frequently only one or two officers are available to answer complaints in the city.

The 128 page study report was prepared by Taylor as his dissertation requirement for a doctor of philosophy in urban studies degree from Portland State University in Portland, Ore.

Chief of Police Edward M. Cunningham told aldermen he agreed to allow Taylor to study the department's records for 1980 after receiving authorization from the council's Fire and Police Committee, adding he did not receive a copy until Monday.

"I think it is an excellent study and reflects the needs of the Jonesboro Police Department," Cunningham said. "I agree with the recommendations outlined in the study furnished to the aldermen.

"I think salaries are low, as re-

flected in the study. I did not know he was going to do this (salary analysis)."

Taylor, a former policeman, said he conducted a study involving 8,360 complaints and calls logged by police during last year. Cunningham said some complaints filed with the Criminal Investigation Division were not among those studies by Taylor.

Taylor gave aldermen a four page list of recommendations. They included:

- Increase the number of commissioned officers by 10, adding three civilian radio dispatchers. The department has 44 commissioned officers.

Taylor stated in his recommendations that it is "impossible for the Jonesboro Police Department to provide efficient and effective police services to the community under existing patrol and manpower conditions."

The recommended level is one officer per 500 residents, or 64 for a city the size of Jonesboro. "We don't need 64. We need 54. We have a low crime rate and want to keep it that way."

- Placing a low priority on some functions now provided by the department, including escorts for funerals, security provided for sports and entertainment events and custodial security provided for banks and merchants.

- A proposed ordinance that would authorize a fine for turning in false alarms. The department responded to 875 false alarms during 1980, the study said, including more than 200

at one business alone. Most false alarms were blamed on faulty equipment.

Department personnel spent more than 580 man-hours answering false alarms during 1980, equal to 14 weeks of work by one officer assigned to a 40 hour work week.

The study said many cities have adopted ordinances that would assess a business or individual \$50 for each police response after the third false alarm in one month.

- The salary ranges between ranks is minimal. Taylor recommended a 12 to 15 per cent differential to encourage officers to work for promotion. "There is no reward for doing a good job."

- Salaries should be increased by 15 per cent, raising the annual salary of a patrolman with three years experience from \$11,052 to \$12,700. Arkansas cities surveyed in the salary study included Springdale, Blytheville, El Dorado, West Memphis, Jacksonville, Fayetteville and Hot Springs.

A patrolman with the West Memphis Police Department draws a \$14,928 annual salary after three years.

Taylor noted in the study Jonesboro has the second largest municipal budget of the eight cities surveyed, but only allocates 17 per cent of the municipal budget for police services. The percentage of municipal budgets earmarked for police services ranged from 31 per cent (Springdale and El Dorado) to 20 per cent (Fayetteville and Hot Springs).

(See POLICE Page 2)

Police—

(Continued From Page 1)

Spring).

Police manpower is spread thin, Taylor told aldermen, with only "one to two officers on the street at any given time." However, he said officers answer the average complaint in four minutes and 44 seconds, well below national norms.

- He recommended changing the boundaries of the four patrol sectors or beats and the assignment of a two-man tactical car to answer certain type calls. The latter, he explained, should be assigned to work from 6 in the evening to 2 in the morning during the period when officers receive the most complaints.

Taylor said the study indicated 70 per cent of the calls answered by police were in an area bounded by Cate on the north, Kitchen on the east, Nettleton on the south and Flint on the west.

Other areas involving an unusually high percentage of calls, includ-

ing traffic accidents and criminal complaints, were in North and East Jonesboro.

The latter area included Caraway Road from Matthews to a point between Highland and Race. The latter area has the highest accident rate in the city.

Taylor said the area in North Jonesboro is bounded on the north by Forrest, Culberhouse on the west, Johnson on the south and Allis on the east.

Aldermen accepted the study and recommendations without comment.

Herbert Davis, director of the municipal Department of Finance and Administration, was asked what he thought of the recommendations. He answered with a question. "Where do we get the money?"

Cunningham was asked if he thought any of the recommendations would be adopted. "You'll have to talk to the City Council," he replied.

Alderman Junior Haggemacher said after the council meeting adjourned he had hoped Taylor would also recommend "a formula for the revenue."

"I'm not making any comments on where the money should come from," Cunningham said in response to a question. "That is the prerogative of the City Council."

Cunningham said Taylor has also conducted evaluations of police departments in Detroit and East Lansing, Mich., as a member of a team assigned to the agencies.

Figure 10: The Jonesboro Sun, 77:151,
Front Page, May 5, 1981.

Mayor Aware Police Underpaid

213

Jonesboro Mayor Neil Stallings told listeners of KASU's Current Focus radio program Wednesday he has known for some time that city police officers are underpaid. However, he added some "figures" used in a extensive Police Department study may be incorrect and are being checked.

Stallings said the study, which was done by Robert W. Taylor, instructor in and coordinator for law enforcement at Arkansas State University, is "certainly partly correct." However, there are still some questions concerning parts of the study.

Taylor submitted the 128 page study to Jonesboro alderman Monday night during their regular meeting. In the study, Taylor said Jonesboro needs a additional 10 city officers and three radio dispatchers. He also said that officers salaries should be raised 15 percent.

Stallings told listeners that he had not seen the study until Monday night and has not drawn any definite conclusions. However, he said he has known for "a long time" that

city employes, including police, are underpaid, and for the past 15 years, he said he has tried to add to salaries as much as possible.

However, Stallings questioned the proposal in the study of a 10 officer increase. He said that Jonesboro has a lower crime rate than most cities it's size has, citing that "five or six years ago," Jonesboro had the lowest crime rate of cities of 25,000 or more population in the country. He said that crime rate is still low.

"The residents of the city are the ones that should tell me (if additional officers are needed)," Stallings said. "We don't have all the problems that other cities have."

Stallings said he thought that the city needed about three more officers on duty. He added that Jonesboro may not need as many officers as other cities used in the study for comparison.

The mayor told listeners that, while not completely bleak, the city's financial condition is not as good as it has been.

He explained that because of state and federal cuts, "some services have and will be cut." The mayor added that some city services that have been enjoyed by city residents in the past will be discontinued. "People will just have to do some of this on their own," Stallings said.

However, Stallings added that state and federal cuts would not be as hard felt if the city could levy a one-cent sales tax, adding many individuals who don't live in Jonesboro are using city services when they come to Jonesboro to shop and work and are not paying for the services. Such a tax, he said, would bring their money in for city use and help lighten the tax burden on Jonesboro residents.

Stallings said he would do everything he could to generate interest in such a proposal. He quickly added he will not pursue the issue if residents did not show some kind of interest.

Stallings said a one-cent sales tax would generate some \$2.5 million dollars for the city annually. "This sort of thing could decrease some

things Jonesboro residents are paying for," he said.

Jonesboro, Stallings said, has been fortunate in receiving grants. The city has received some \$1.5 million of Housing and Urban Development (HUD) grants in the last year to renovate the "poorer section of town."

"They (those who award grants) know that if Jonesboro is given a grant, the job will be done," Stallings said. Stallings credited Jim McKinnon, director of the Jonesboro Urban Renewal and Housing Authority, with a job well done.

Current Focus is presented each Wednesday at 11 in the morning by KASU and sponsored by the Jonesboro League of Women Voters.

Mayor, Researcher Dispute Police Study

By TONY BIFFLE

From The Commercial Appeal
Jonesboro, Ark., Bureau

JONESBORO, Ark. — A report that calls law enforcement conditions in Jonesboro "impossible" has provoked disagreement between the mayor and the report's author.

Mayor Neil Stallings said he would be "highly surprised" if all the information in a study by Robert Taylor is accurate. Taylor, coordinator of law enforcement studies at Arkansas State University, presented a summary of his 128-page report on the Jonesboro Police Department to the City Council Monday night.

Stallings said he agreed with the report that Jonesboro policemen should be paid more. He said he doubted, however, that the percentage of the city budget spent on the Police Department, as given in the study, is accurate.

The study said Jonesboro spends 17 per cent of its money on police protection. Stallings said the figure was closer to 30 per cent. The study indicated Jonesboro spends a smaller percentage of its city budget on its police than other Arkansas cities of similar size.

"I don't care what per cent we get," said Jonesboro Police Chief Ed Cunningham. "I'm only interested in getting the money that insures Jonesboro has an effective police department — whether it's 7 or 17 per cent is unimportant.

"I'll run the department with what they give me to run it with."

Cunningham said he had no reason to doubt the accuracy of Taylor's study dealing with salaries and police budgets. He said the parts of the study concerning the actual operations of the department were "accurate — period" because they were based on the department's own records.

The study, Taylor's doctoral thesis, makes five recommendations:

- Hire at least 10 policemen and 3 civilian radio dispatchers.
- Change boundaries of Jonesboro's four police districts to equalize the work loads of each and create a "fifth district," which would overlap the two districts most often requesting police help.
- Continue placing a low priority on some police functions, such as funeral escorts and security at sporting events.
- Increase pay.
- Increase the pay differences between ranks in the department.

Taylor was defending his study this week after the mayor said on a local radio program that the study may be comparing "apples to oranges" in some instances.

"I'm offended that the mayor questioned my ability to portray the city of Jonesboro... The study was fact, not conjecture," Taylor said, adding he had assisted with similar studies for East Lansing and Detroit while a student at Michigan State University.

Stallings said the city cannot afford to hire additional policemen or civilian dispatchers unless another source of revenue becomes available. Both he and Cunningham suggested a one-cent sales tax as a possible revenue source.

"A one-cent sales tax would be one good way to get money to run the city government," Cunningham said. "It's a fair tax, if any tax can be fair."

Stallings said the sales tax was "in the wings," but would have to be approved by Jonesboro voters in a referendum. He said an election on the question could be held later this year.

Without the tax, the mayor said there was no way to hire additional policemen. "We don't pay our officers enough," Stallings said, "but we pay all we have to pay them with."

Stallings, Cunningham and Taylor all agreed priorities have to be set regarding spending city funds, but Taylor took the strongest exception to the city's current priority list.

"Having been a police officer," Taylor said, "I'm appalled at the conditions in the Jonesboro Police Department. At these salaries, law enforcement is not a profession. The individual officers are to be highly commended for adapting to Jonesboro's spending policies."

Taylor's study compares salaries of Jonesboro policemen with other police salaries in Arkansas cities of similar size. Those comparisons are being checked by city Finance Director Herb Davis, Stallings said.

The study, according to Taylor, discovered that Jonesboro has a "portrayed low crime rate." Taylor said the city's low crime rate figures do not reflect incident or complaint reports that do not require police followup investigations.

Taylor said conditions in Jonesboro today make it "impossible" to provide efficient and effective police protection. "It's only a matter of time," he said, "before a policeman gets hurt or a person gets hurt due to inadequate police protection."

Figure 12: The Commercial Appeal, 142:128, Section B, page 1, Memphis, Tennessee, May 8, 1981.